February 1939

TECHNOLOGY REVIEW

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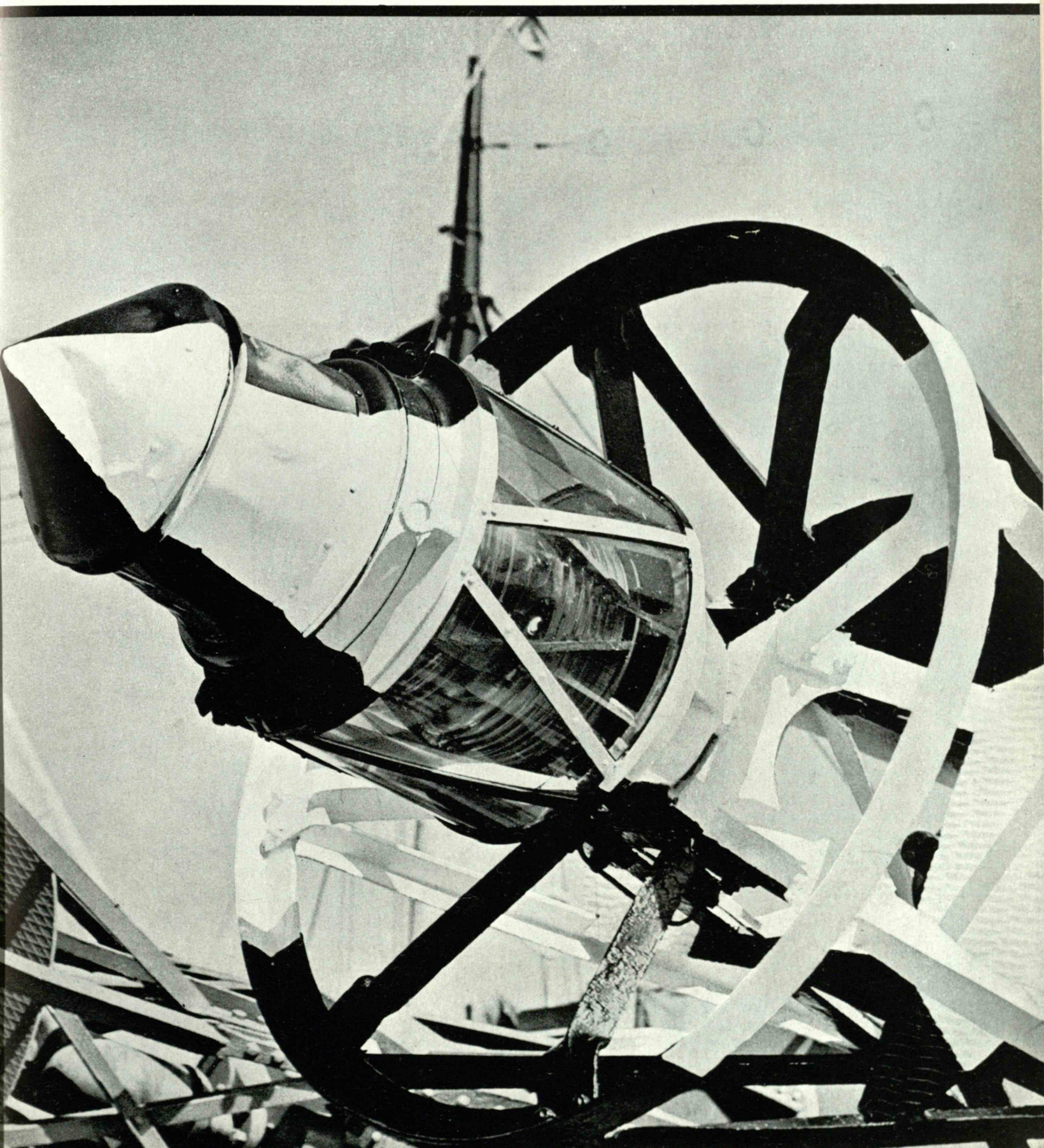


technology
review
Published by MIT

THE TECHNOLOGY REVIEW, February, 1939. Vol. XLI, No. 4. Published monthly from November to July inclusive at 10 Ferry Street, Concord, N. H. Publication date: twenty-seventh of the month preceding date of issue. Annual subscription $3.50; Canadian and Foreign subscription $4.00. Entered as second-class matter at the Post Office at Concord, N. H., under the Act of March 3, 1879.

THE TABULAR VIEW

FOR the possibly doubtful honor of labeling the puzzling times in which we live, according to some commentators, electricity has but one serious rival. In so many ways and for so many things do we depend upon the lens — for amusement, record, health, investigation — that to call this the age of the lens appeals to them as reasonably accurate. The Review is content with remarking the diverse virtues of the lens, the extremes of its usefulness, suggested in two articles this month. Contour of the far-flung jungle, configuration of the microscopic fiber, each is by its aid added to man's working knowledge. ¶ HAROLD G. CROWLEY, '23, as chief of the air survey unit of the Papua Oil Development Company, Ltd., which mapped the New Guinea jungle, relates high lights in his recent years (page 163). Before his work in New Guinea, he took part in air operations for the two Forbes-Grenfell-MacMillan expeditions for the mapping of the Labrador Coast, the story of which he told in The Review for February, 1933. The economic aspects of the New Guinea oil search are not touched upon in his present article, since as explorer he was not concerned with that phase of the development. ¶ The second votary of the lens who contributes to The Review this month (page 166) is likewise familiar: Classmate of Mr. Crowley, EDWARD R. SCHWARZ, as professor of textile engineering at the Institute, has been in the forefront of the effort to rationalize the utilization of fibers. Ability to manufacture artificial fibers, which has already given rise to great industries, may in time become ability to design and construct fibers of special fitness for special tasks; it is this provocative possibility with which Professor Schwarz is currently concerned. ¶ Antiquary of applied technology, L. L. THWING, '03, who in The Review for October, 1934, rescued from near oblivion a pioneer in the application of electricity, now (page 169) tells of two early experimenters with the art of automobility. His article is another outgrowth of an avocation that turned into a profession when, after riding for years the hobby of collecting data on the history of technology, he became connected with the New York Museum of Science and Industry. ¶ Another aspect of transportation is commented upon in this issue by JAYSON C. BALSBAUGH, '24, Associate Professor of Electric Power and Distribution, who reviews Lucius Beebe's "High Iron" with the interest of both teacher and *aficionado* (page 160).

TO the Cover Club this month comes as a new member, CLAYTON D. GROVER, '22, whose photograph of a freshly bedecked buoy was taken at the United States Lighthouse Service depot at Woods Hole, Mass. ¶ Proposal that The Review publish monthly a list of staff papers to supplement the list of alumni publications now carried was made in our November issue by Professor Leicester F. Hamilton, '14. Response to the editorial query thereto appended has thus far been scattering; failing further expression of desire by readers, The Review presents no list, waits.

MAIL RETURNS

Further Aims for Management

FROM WILLIAM A. RHODES, '12:

If one might be so bold as to attempt supplementing President Compton's summary of the problems of management in the December Review, one might add the following as specific objectives which are perhaps especially pertinent at the present time:

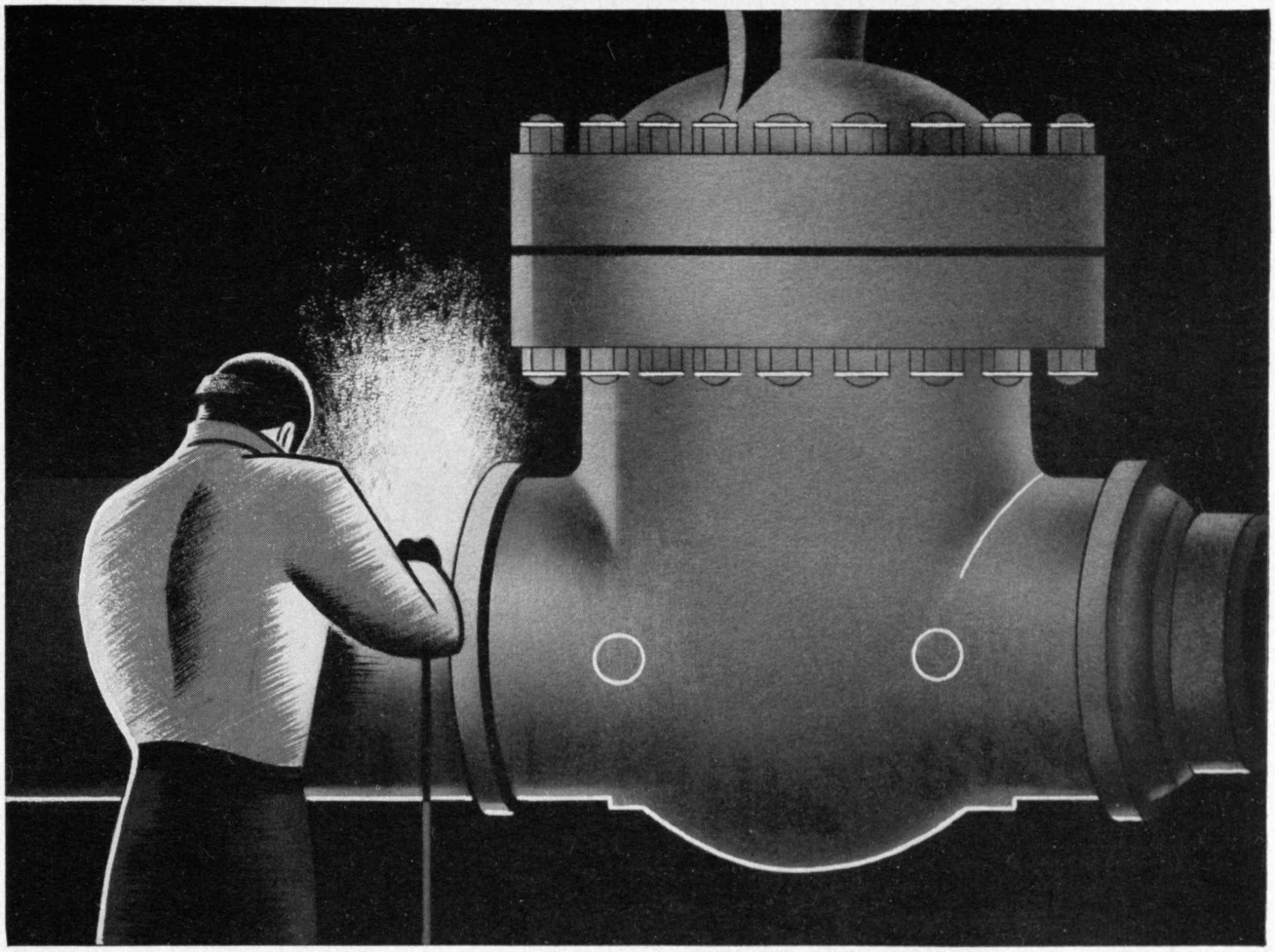
(1) The production of goods and of services suitable in kind and in price for sale to the poorer populations. It so happens that this class of production requires the most costly and elaborate plant, the most skilled of technicians.

(2) The employment of the poorer populations at work for which they are best fitted. This is repetitious hand labor, and an example of it is in the work of machine and instrument and commodity assembly. It very frequently pays to ship materials and parts to low-wage areas for hand labor and back to market for sale. It so happens that the class of goods containing a high percentage of handwork tends toward luxury products and is chiefly salable in the richer districts.

It is by the applications of the principles of management so ably stated by President Compton — supplements, after all, are secondary affairs — that more human desires are to be satisfied and the potential labor of those now idle or poorly occupied is to be utilized to the benefit of everyone concerned in all professions, work, and trades.

New York, N. Y.

Readers who wish to join Mr. Rhodes in further projection of the fundamentals set up in President Compton's statement may desire reprints of the article, "New Demands on Technology." These may be obtained from The Review.



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... your vital problem right now is a better product at a competitive cost; and improved materials may be the answer. Better re-check your material specifications today for Molybdenum steels. They are continually replacing other long established steels.

Here's a concrete case. Several important manufacturers of steam generating equipment have adopted Carbon-Molybdenum steel for many different parts. They find it has the better elevated temperature properties and creep strength necessary for the high temperatures common to modern plants. They also find that it is suitable for welded construction (many installations today are of welded construction).

What is more, Carbon-Molybdenum steel not only meets the physical requirements exactly but also comes within the cost limitations that usually exist.

We will gladly send our booklet, "Molybdenum in Steel", containing a great deal of practical data, free to technical students and others interested in improved materials giving more per alloy dollar.

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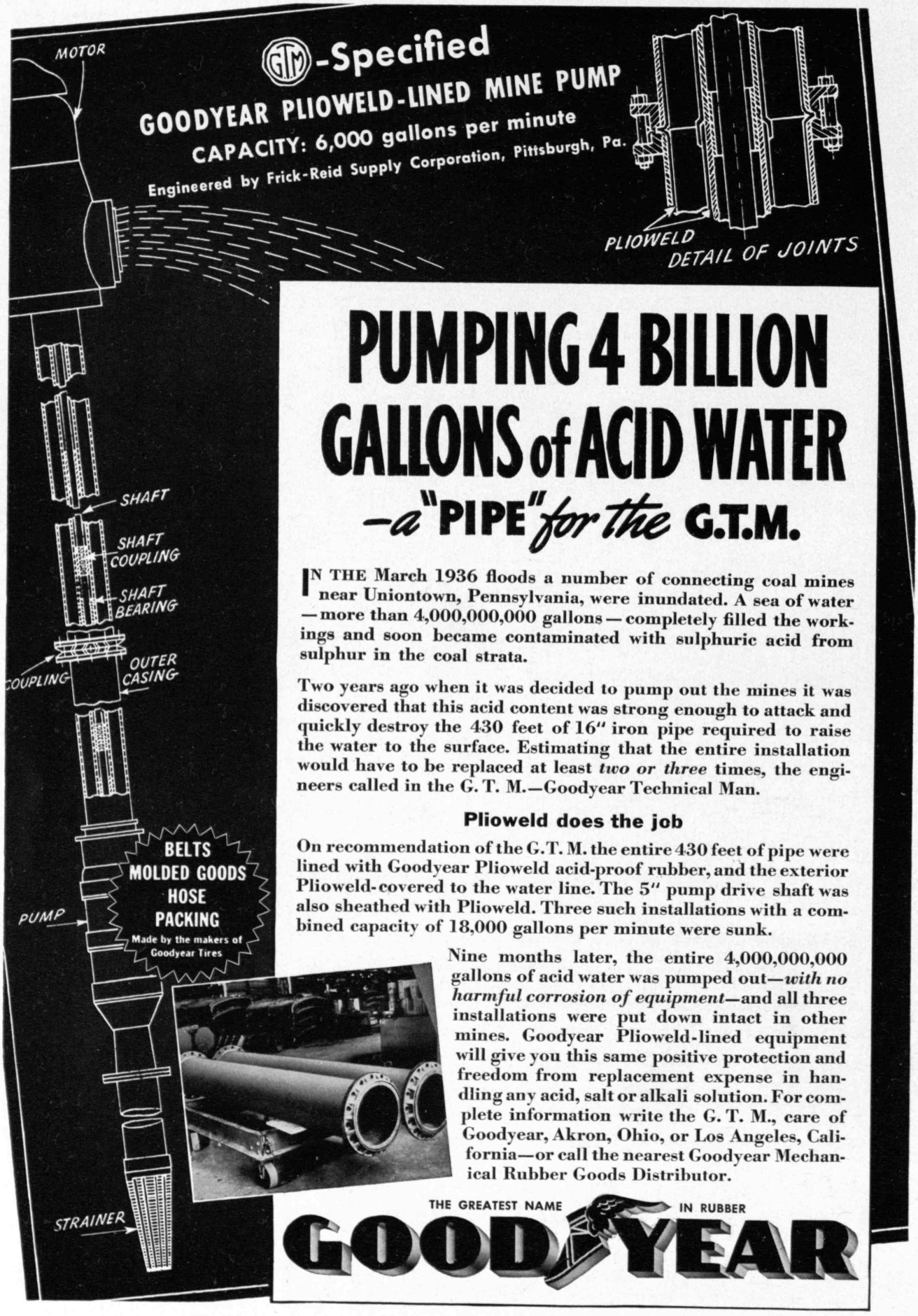
MOLY



PUMPING 4 BILLION GALLONS of ACID WATER

—a "PIPE" *for the* G.T.M.

IN THE March 1936 floods a number of connecting coal mines near Uniontown, Pennsylvania, were inundated. A sea of water—more than 4,000,000,000 gallons—completely filled the workings and soon became contaminated with sulphuric acid from sulphur in the coal strata.

Two years ago when it was decided to pump out the mines it was discovered that this acid content was strong enough to attack and quickly destroy the 430 feet of 16" iron pipe required to raise the water to the surface. Estimating that the entire installation would have to be replaced at least *two or three* times, the engineers called in the G. T. M.—Goodyear Technical Man.

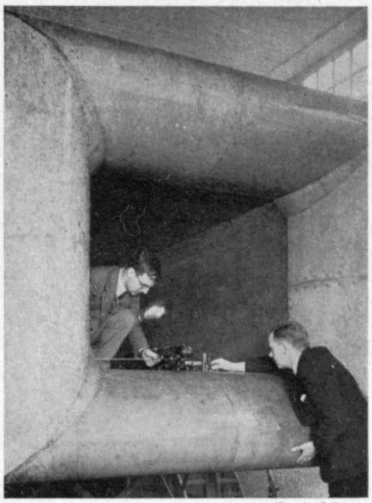
Plioweld does the job

On recommendation of the G.T. M. the entire 430 feet of pipe were lined with Goodyear Plioweld acid-proof rubber, and the exterior Plioweld-covered to the water line. The 5" pump drive shaft was also sheathed with Plioweld. Three such installations with a combined capacity of 18,000 gallons per minute were sunk.

Nine months later, the entire 4,000,000,000 gallons of acid water was pumped out—*with no harmful corrosion of equipment*—and all three installations were put down intact in other mines. Goodyear Plioweld-lined equipment will give you this same positive protection and freedom from replacement expense in handling any acid, salt or alkali solution. For complete information write the G. T. M., care of Goodyear, Akron, Ohio, or Los Angeles, California—or call the nearest Goodyear Mechanical Rubber Goods Distributor.

THE GREATEST NAME IN RUBBER

GOODYEAR



Topical Press

This wind tunnel tests streamline model locomotives at the Derby works of the London, Midland and Scottish Railway

THE TECHNOLOGY REVIEW

Title Reg. U. S. Pat. Office

EDITED AT THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY

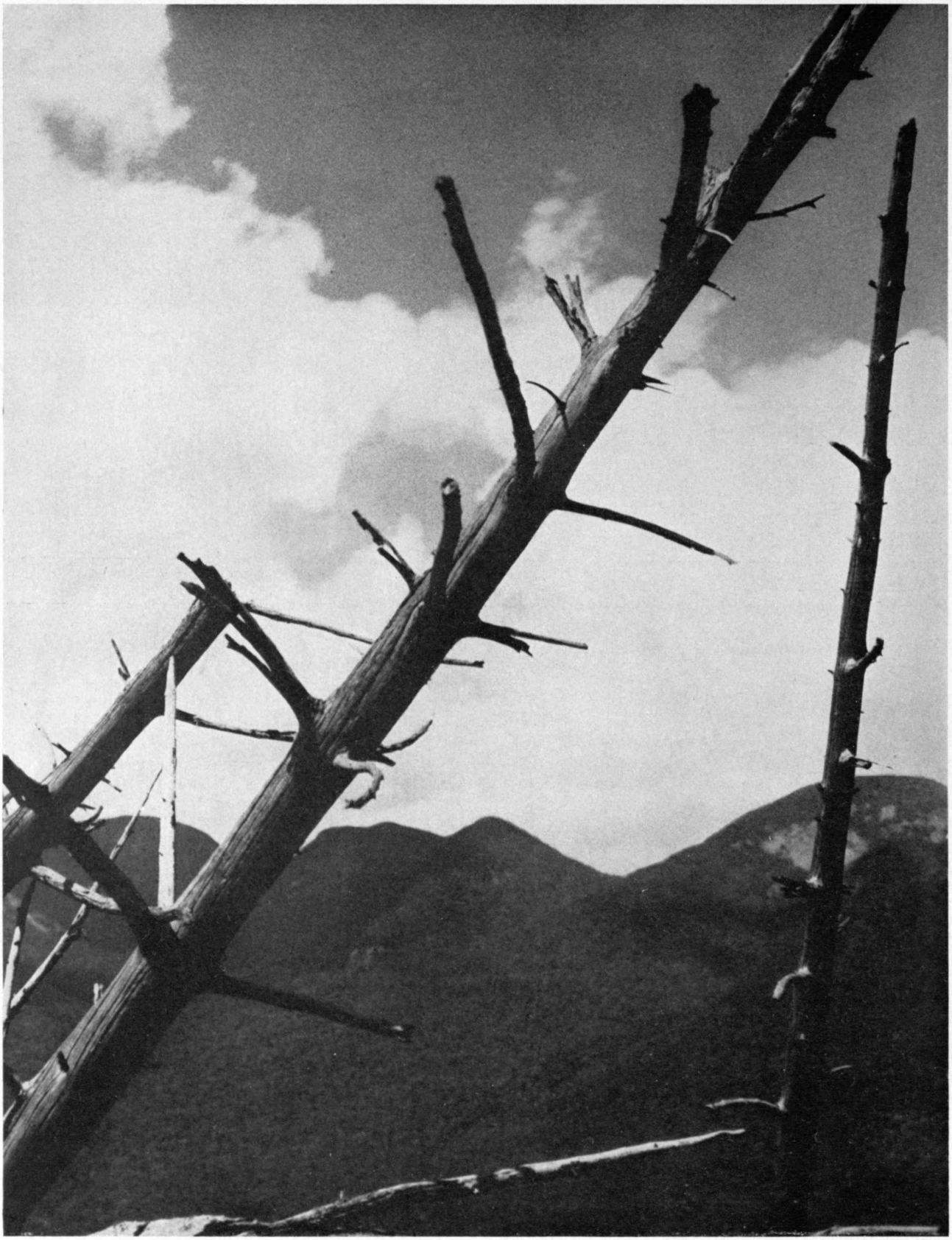
VOL. 41, NO. 4 — FEBRUARY, 1939

CONTENTS

THE COVER

From a photograph by Clayton D. Grover, '22

PUBLISHED MONTHLY FROM NOVEMBER TO JULY INCLUSIVE ON THE TWENTY-SEVENTH OF THE MONTH PRECEDING THE DATE OF ISSUE AT 50 CENTS A COPY. ANNUAL SUBSCRIPTION $3.50; CANADIAN AND FOREIGN SUBSCRIPTION $4.00. PUBLISHED FOR THE ALUMNI ASSOCIATION OF THE M.I.T. H. B. RICHMOND, PRESIDENT; ARTHUR L. TOWNSEND, RAYMOND STEVENS, VICE-PRESIDENTS; CHARLES E. LOCKE, SECRETARY; RALPH T. JOPE, TREASURER. PUBLISHED AT THE RUMFORD PRESS, 10 FERRY STREET, CONCORD, N. H. EDITORIAL OFFICE, ROOM 3-219, MASSACHUSETTS INSTITUTE OF TECHNOLOGY, CAMBRIDGE A, MASS. ENTERED AS SECOND-CLASS MAIL MATTER AT THE POST OFFICE AT CONCORD, N. H. COPYRIGHT, 1939, BY THE ALUMNI ASSOCIATION OF THE MASSACHUSETTS INSTITUTE OF TECHNOLOGY. THREE WEEKS MUST BE ALLOWED TO EFFECT CHANGES OF ADDRESS. BOTH OLD AND NEW ADDRESSES SHOULD BE GIVEN



George A. Makaroff, '26

FAR FORESTS

Peaks and spurs in the Adirondacks with a foreground of trees that were

THE
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REVIEW

Vol. 41, No. 4

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The Trend of Affairs

From Liége to the Sea

A GREAT engineering feat which might well have attracted more attention were it not for the long succession of crises in Europe will be completed next summer when Belgium opens the Albert Canal, her new and potentially most important waterway. Winding its way across country from Liége, on the Meuse River, to Antwerp, the great North Sea port, the new canal will provide a much needed highway of commerce from Belgium's rich coal and industrial districts to the seaboard.

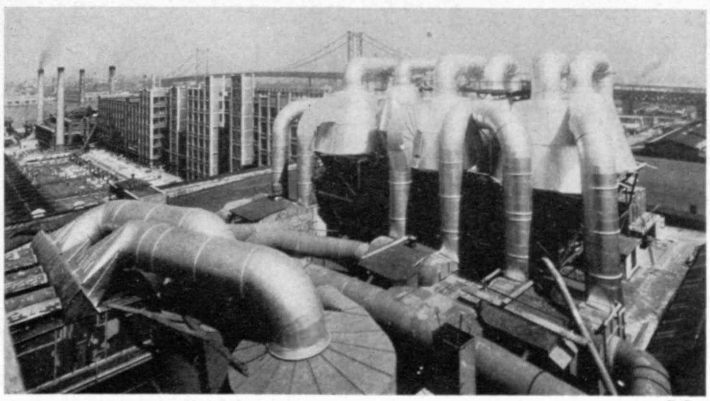
The Albert Canal, started in 1930, will cost some $500,000,000, and its completion is expected to swing to Antwerp the tide of commerce that now flows to Rotterdam by way of the Meuse River and the Juliana Canal. In contrast with the existing system — a shallow waterway that leisurely winds across Belgium and at one place wanders into Holland, with consequent customs entanglements — the new canal is being constructed entirely within the borders of Belgium itself.

The old canal route between Liége and Antwerp, which has been in existence for many years, is slightly more than 96 miles long and necessitates the tedious passage of 23 locks. The new canal is nearly 78 miles long, but because there are only six locks, the passage between the two cities will be very much faster.

The new waterway will accommodate vessels up to 1,350 tons, and special features of construction will permit ships to operate at full speed without endangering the banks of the canal by the effects of turbulence.

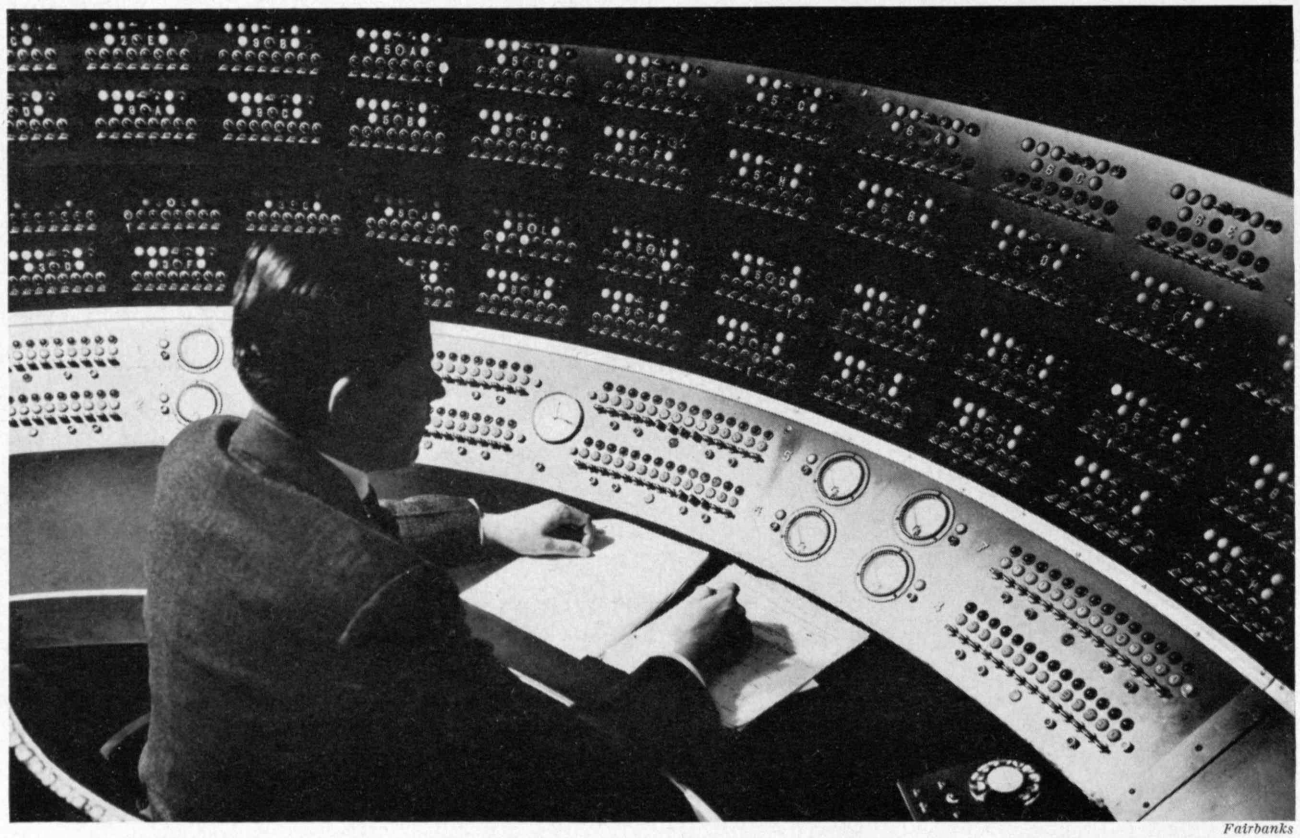
The present competing waterway between Liége and Rotterdam is 141 miles long, but because it can accommodate larger vessels than those that can navigate the present Liége-Antwerp Canal, it has carried a huge volume of traffic to the Dutch port. This route follows the Juliana Canal on the Meuse River and later joins the Waal River, southeast of Rotterdam.

The new Albert Canal has a width of 85.3 feet on the bottom; its channel has a depth of 16.4 feet and measures 11.48 feet at the sides. With the exception of three drawbridges near Antwerp, all bridges are fixed structures built at a height to give ample clearance for any vessel using the waterway. Estimates indicate that the canal will have a traffic capacity of fifteen million tons of freight a year. This is many times greater than the maximum of the existing system between the Meuse and Antwerp. In order to facilitate traffic, large basins have been provided at each lock, permitting the rapid handling of vessels. Disturbance of the water during the process of filling and discharging the locks will be reduced to a minimum by means of new methods of control.



R.C.A.

Liége lies in the Meuse Valley near the eastern frontier of Belgium — a coal region. It is an important center for metal products and is noted for its ordnance works, where much of Belgium's arms and muni-



Fairbanks

WHERE THE NETWORK CENTERS

A section of N.B.C.'s main control desk, with lights representing the different studios and 85 stations on the coast-to-coast hookup — all under the operator's control

tions are manufactured. Near by are also diversified industrial plants for the construction of railroad equipment and machinery. Thus the new waterway will have significant military importance, in addition to its value to commerce.

Determined to build a canal securely within the frontiers of Belgium, the government engineers turned their eyes from the line of least resistance along the paths of existing canals and streams, and boldly struck across the formidable plateau that stretches along the Meuse River. Here they lifted the canal over a ridge more than 330 feet in elevation. This difficult feat was accomplished without compromise with the requirement that the water supply flow from the Meuse to Antwerp. Thus the canal progresses from the valley of the Meuse and dips into the watershed of the River Scheldt near Antwerp. This undertaking necessitated enormous cuts through solid rock, clay, and unstable subsoil. The vast amount of material excavated was used in building embankments along the route where the new canal was superimposed on the old waterway.

Rhumbatrons and Electrons

TO the electrical communications art of tomorrow efficient devices capable of generating, modulating, and receiving electric waves of but a few centimeters in length will be essential. By many noteworthy advances, the ordinary vacuum tube has been refined, reshaped, and generally overhauled until, watchlike, it is beautiful and indispensable and is a precision instrument as well. Despite these remarkable developments since the introduction of the historic audion of Dr. Lee De Forest in 1906, the communications engineer has been awaiting the contribution that would be to the art of tomorrow what the audion was to the communications art of the last three decades.

A dynamic group of researchers on the West Coast has turned the trick. Four members of the physics department of Stanford University — two brothers, Russell H. and Sigurd F. Varian, William W. Hansen (National Research Fellow at M.I.T. in 1933–1934), and David L. Webster (Assistant Professor of Physics at the Institute in 1919–1920) — are the workers concerned. At a recent colloquium of the Institute's Department of Electrical Engineering, Dr. Webster told for the first time of the development of a new type of ultrahigh-frequency generator and receiver working on principles strikingly different from those of the ordinary vacuum tube. Known in one of its embodiments as a klystron, the new device has overcome the objectionable features that have so long limited the applications of present-day tubes in the ultrahigh-frequency and communications field.

In the klystron a beam of electrons representing a constant current is sent through two resonant metal containers, known classically as rhumbatrons by the research workers at Stanford. In the first rhumbatron is an oscillating electric field, parallel to the stream and of such strength as to change the speeds of the

electrons by appreciable fractions of their initial speed, accelerating some and slowing down others. After passing this rhumbatron, the electrons with increased speeds begin to overtake those with decreased speeds which are ahead of them. This motion groups the electrons into bunches separated by relatively empty spaces. A considerable fraction of the energy of these groups can then be converted into power of high-frequency oscillations by passage of the stream through the second rhumbatron, within which is an oscillating electric field so changing synchronously as to take energy away from the electrons in the bunches.

If the first rhumbatron (which is called the buncher) is driven by an external source of power, such as an antenna receiving radiation, and the electrons are strong enough to give the second rhumbatron (which is called the catcher) more power than the antenna gives to the buncher, the klystron is acting as an amplifier. If the buncher is driven by power received through a coupling loop or otherwise from the catcher, the klystron is acting as an oscillator. And finally, if the buncher is driven by power from both of these sources at once, the klystron is acting as a regenerative amplifier.

It seems safe to state that this highly interesting development will lead the engineering and scientific world into a new era of ultrahigh-frequency technique. It is, for example, exactly the sort of device needed for the best operation of telephone lines using hollow pipes to guide high-frequency waves, as proposed by Wilmer L. Barrow, '29, Assistant Professor in the Institute's Department of Electrical Engineering, or for directed radio communication by means of his electromagnetic horns, essential to safe blind landing of airplanes.

The News Flies

LATEST step in speeding the news is the broadcasting of facsimile newspapers — a development which reached practicality in the closing weeks of the news-crowded year just behind us. Using ultrahigh frequency, W9XZY, a radio facsimile broadcasting station operated by the St. Louis *Post-Dispatch*, commenced the first regular facsimile newspaper service. No. 1 of Volume 1 of the first radio edition of the *Post-Dispatch* consisted of nine pages, eight and a half inches long, four columns wide, using regular seven-point type.

Receiving sets — the first capable of handling high-frequency facsimile broadcasts — have been developed by the Radio Corporation of America. These are so designed that they start and stop automatically at the beginning and close of the broadcast. Fifteen minutes are required for the transmission of one page. Since these receivers work on ultrahigh frequencies, operation during any hour of the day is possible; earlier experimental equipment employing standard broadcast wavelengths could be used only in the early morning hours. Receivers are to be installed in public places for demonstrations within W9XZY's broadcasting range of 20 to 30 miles on 31,600 kilocycles.

International Nickel Company

Her holds are nickel-lined for the bulk transportation of corrosives such as lye; her hull consists of welded steel channels. The twin-screw Diesel ship Dolomite 4, *gross tonnage 5,500*

Charles Phelps Cushing

A pioneer filling station in Kansas City, Mo., in days before the name had reached the dictionaries. "Sometimes it supplies as many as 60 autos with gasoline in a single day," said a newspaper observer

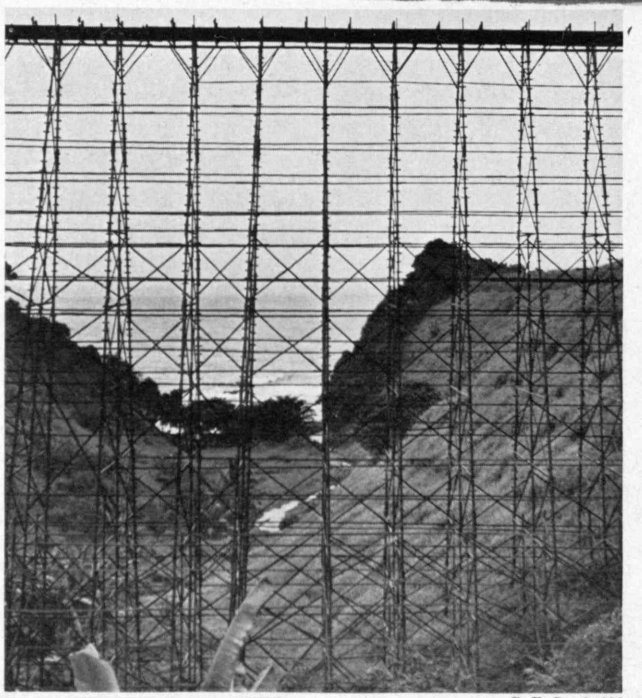
Charles Phelps Cushing

And still in nostalgic vein — beginnings of bus business: a small-town liveryman of 1910 awaiting the fare of a passenger and, meanwhile, being tendered the open-mouthed admiration of youth

Bauhaus Resurgens?

THE recent exhibition of the work of the German Bauhaus at the Museum of Modern Art in New York has created a storm of unobjective criticism and of unobjective praise. Such controversy is no new thing for the Bauhaus. It began with the opposition of conservatives to the opening at Weimar in 1919. It persisted in the strong opposition of the craftsmen of Germany. Among the personnel it was noted in the departure of the piôneer, Itten, in 1923 because of disagreement over the conduct of a course, and in later criticism of the directors who succeeded Gropius. It ended in debacle when the present political leaders of Germany achieved "the illusion that modern furniture, flat-roofed architecture, and abstract painting were degenerate or Bolshevist," and closed the Bauhaus for good. It has renewed itself in this country in the unresolved confusion surrounding the row between the volatile Moholy-Nagy and the sponsors of Chicago's "New Bauhaus." Now so much controversy does not center around a dead issue. So the question comes forcefully to us whether or not the exhibition and the catalogue are, as some people have suggested, "merely a belated wreath laid upon the tomb of brave events, important in their day but now of primarily historical interest."

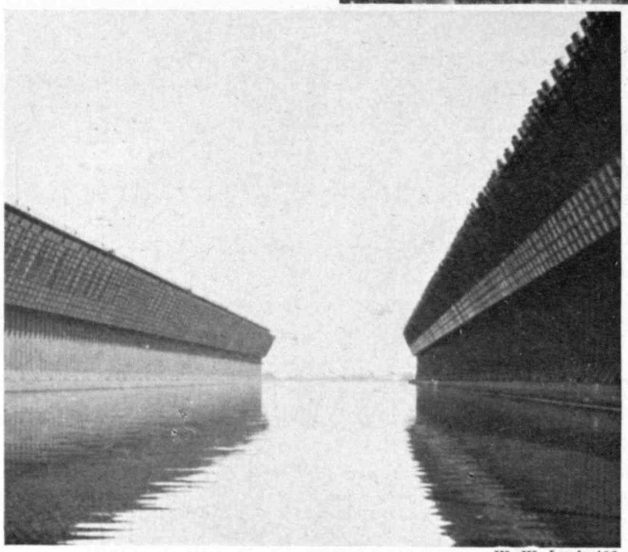
W. W. Drummey, '16



C. E. Patch, '02

STUDIES IN ANGULARITY

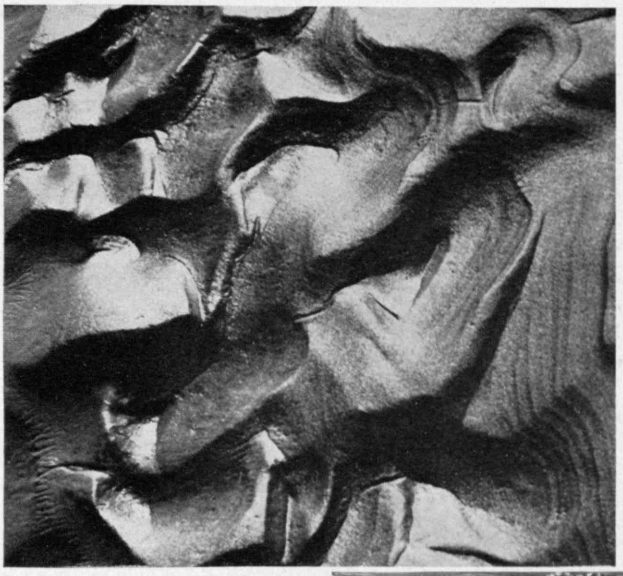
. . . as the camera finds them variously embodied in Lake Superior ore docks, below; Hawaiian sugar flume trestle, center; Boston Elevated Railway maintenance shop, above



W. W. Lewis, '89

At the outset the exhibition might serve to remind us how many of the Bauhauslers are now in this country, influencing our theory and our practice of art education. Not only are Gropius and Breuer at Harvard University; Mies van der Rohe, Hilbersheimer, and Peterhans are at Armour Institute, Chicago; Albers and Schawinsky, at Black Mountain College in North Carolina. Former students teach at the Laboratory School of Industrial Design in New York and at the Southern California School of Design. Moreover, Moholy-Nagy, Bredendieck, and Kepes — lately departed from the New Bauhaus — will presumably come to light somewhere. With so much possible influence on our art students, one can no longer neglect the probable significance of the Bauhaus to America.

The educational plan as carried out when the Bauhaus was in Germany laid equal emphasis on instruction in crafts and on instruction in form problems. Dexterity in the manual crafts was cultivated, however, not for its own sake but as a preparation for designing for mass production. The curriculum began with a preliminary course of one half year with elementary instruction in form and with practical (tactile and manipulative) experiments with different materials. Those who passed this were admitted to a workshop for a three-year course, after signing legal articles of apprenticeship, entering on a craft which appealed to them. Following this, selected men were educated in architecture for varying times depending on their capacities. All the



courses were supplemented by lectures on more conventional subjects. The entire program was elastic, being based in some degree on Montessori principles.

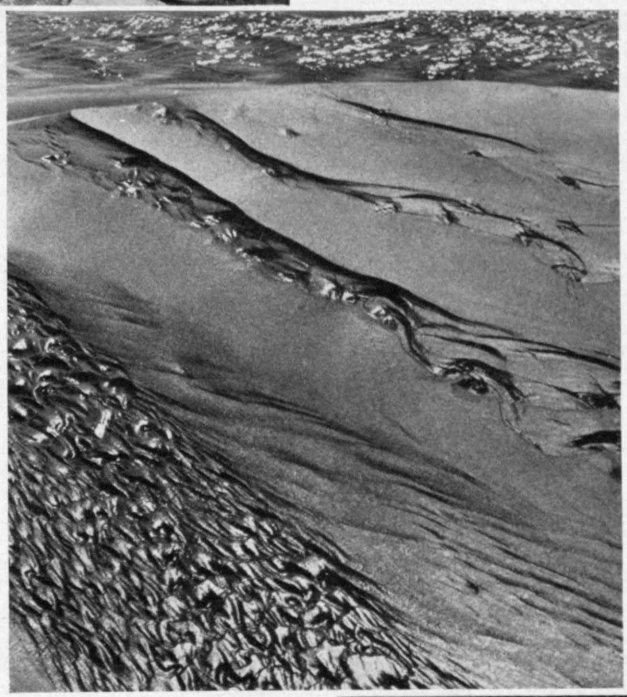
The exhibitions by the Bauhaus (including the recent one) have on the whole not been sufficiently selective with respect to these experimental designs. In their enthusiasm to show all sorts of student work, the Bauhauslers have contrived shows which, though suitable for educators, were likely to confuse the patron or the amateur of art. It is of course possible that the Bauhaus, like some other manifestations of current thinking in the arts, is at its best in writing and is at its worst in execution.

However, it would be unfair to judge the Bauhaus and its methods solely by the criterion of results. As we shall see, the philosophy represents a drastic departure in thinking about art; and even 20 years, particularly 20 years of turmoil, are not enough to prove or disprove such a revolutionary thesis. Particularly one should not lean too heavily on criticism of failures in fields where the technological equipment was not equal to the ambition. It is characteristic of the Bauhaus that there was an intense and sometimes childlike interest in everything, and naturally such prying minds often went off the track. Bad derailments occurred in typography, in the theater, and in prefabrication. Notable arrivals at the destination other than in the distinguished architecture of Gropius and Breuer occurred in ceramics and textiles, and adequate performances were registered in metalworking and illumination. Finally, the tubular-steel chairs by Breuer pretty clearly marked the start of a new era in chair design.

But the past achievements of the Bauhaus are not important for America. If the Bauhaus is to mean anything here, it must be as an educational device. If its transplanted teachers do not develop ideas in their present students, nothing will happen. For it may truly be said of the Bauhaus that it is not a style, and may as truly be declared that if it should ever become a style, it would on that day be dead. There is still no sign of this sort of demise.

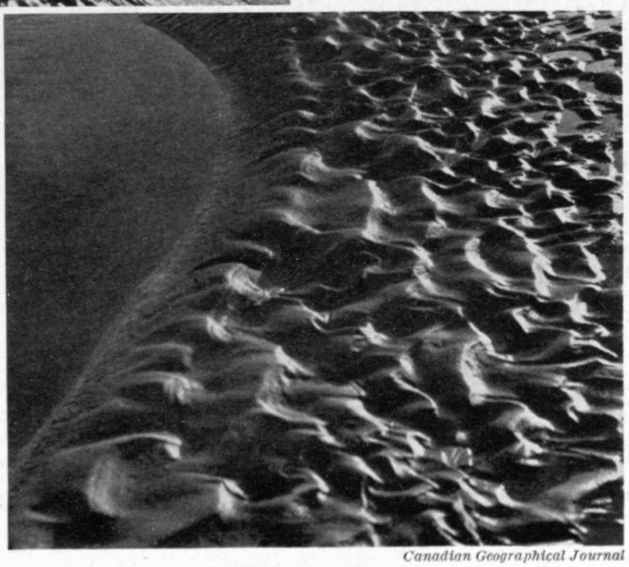
Gropius stated long ago the principles on which Bauhaus teaching still theoretically rests. Some of these, particularly significant to America, are (1) that students will for the most part find their future in industry and mass production rather than in individual craftsmanship; (2) that teachers in schools of design should be men who are in advance of their profession rather than safely and academically in the rear guard; (3) that the school of design should synthesize all the arts, the practical and the fine; (4) that a faculty should include working artists whose primary job is not to teach but to create; (5) that thorough manual experience with materials is essential.

The basic credo is perhaps best expressed by Gropius in a statement from Weimar in 1923: "True creative work can be done only by the man whose knowledge and mas-



SOFTNESS OF CURVES

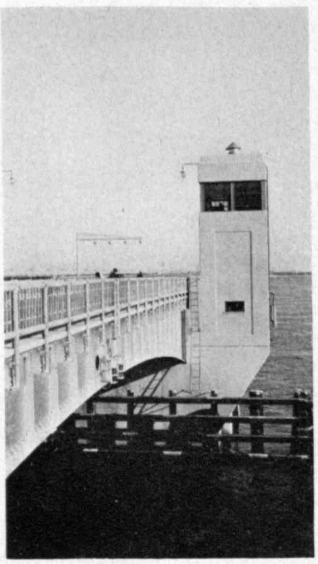
. . . as the tide leaves them on the dangerous flats of the Watternmeer between the estuaries of the Elbe and Weser on the North Sea. Photos by Ehrhardt



Canadian Geographical Journal

tery of the physical laws of statics, dynamics, optics, acoustics, equip him to give life and shape to his inner vision." This is a credo which also fascinates many an engineer and many a scientist.

It is fair to say that, looked at from an engineer's point of view, the actual effort of the Bauhaus to establish a real mastery of science in its artists has been somewhat tentative. Ample attention has been paid to hand- and machine-working of materials, to their superficially observable properties, to their feel, their smell, their looks — in short, to those things which appeal to the artist — but there is little evidence of serious instruction in the science of materials or in the important principles of physics which bear on the problems of construction, whether of building or of object. Perhaps in America the Bauhauslers will embrace an opportunity for that wider collaboration of workers which they may desire. But there is also room to question the thesis itself. Klee once wrote a letter in which he said in part: "We construct and we construct and yet intuition has its uses. Without it we can do a lot but not everything. One may work a long time, do different things, many things, important things, but not everything." It is still hard not to believe that art deals with intuitions and not with scientific principles. There are no formulas for esthetics. Nor would Gropius and his men of the Bauhaus have it otherwise, if they are read aright. All they insist perhaps is that the architect and the industrial artist of today have no right to work in an art-for-art's-sake atmosphere, cannot do even half a job without the kind of technical background from which the artist and architect have for years fled in horror. For this seed brought at long last to America, nearly 20 years after it was sown in Europe, we must all give them thanks, even though we cannot now foresee the harvest.[1]



[1] The reader should examine "Bauhaus, 1919–1928," edited by Herbert Bayer, Walter and Ise Gropius, The Museum of Modern Art, New York, 1938; also the new edition of "The New Vision," by L. Moholy-Nagy, W. W. Norton and Company, Inc., New York, 1938. Finally, to get a more dispassionate orientation of the Bauhaus, it would be well to consult "Cubism and Abstract Art," by Alfred H. Barr, Jr., The Museum of Modern Art, New York, 1936.

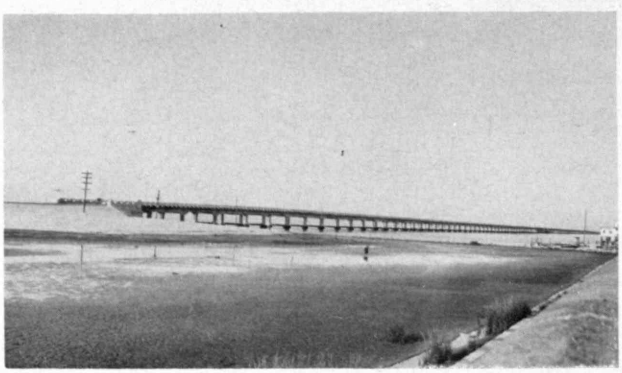
"High Iron"

By J. C. Balsbaugh

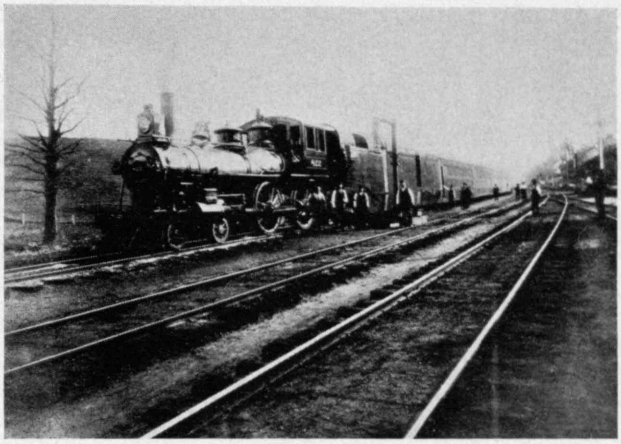
BOTH the dramatic action and the tradition that have made of railroading one of the great sources of American folk song are well displayed in Lucius Beebe's "High Iron" [2]; it is therefore particularly satisfying to have such a book appear while we are in the midst of an acknowledged period of transition in the development of mass transport. Though the book is not intended to be a history of railroading or to trace the evolution of rail transport equipment and motive power, it is nevertheless bound to become a valuable addition to the literature of these subjects. The singular aptness of taste which Mr. Beebe shows in the selection of photographs making up the bulk of the volume assures it such a place. It is, in addition, unsurpassed in its portrayal of the romance and grandeur of steam and steel in the railroad legend.

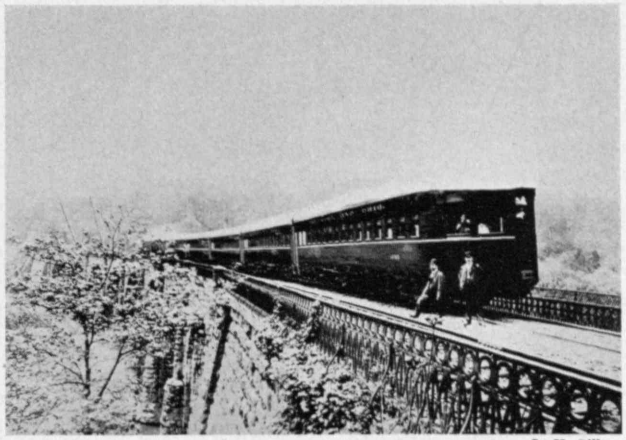
Mr. Beebe is fairly explicit in limiting the scope of his work; this is essentially an enthusiast's book, which has been compiled and written of material that pleased the author, simply because it did please him. But since he is enthusiast enough to have pretty thorough knowledge of his subject, his book contains no glaring gaps. The evolution of steam power, for example, is very effectively presented in non-technical language yet with full attention to the significance of wheel arrangement, the characteristics of steam power, the relative significance of tractive effort and horsepower rating, and the requirements for passenger and freight service. Recent trends in steam power are clearly described, both through discussion of proportionally larger grate area and boiler, with consequent increased steaming capacity at speed, and through explanation in terms of wheel arrangement involving the more general use of a four-wheel trailing truck. This development is one en-

[2] New York: Appleton-Century, 1938. 225 pages, $5.00.



Completed in December by the Texas State Highway Department from the designs of Terrell Bartlett, '06, the Galveston Causeway connects the "Atlantic City of the Gulf Coast" with the mainland. Its length is 8,194.5 feet; it has four 10-foot lanes. The draw span pictured at the right is a double-leaf bascule over the intercoastal canal, with a clear opening of 105 feet and unlimited vertical clearance. Design involved precautions against storm damage possible because of the city's exposed position





L. K. Sillcox

Described in print by Frederick U. Adams in 1892, this application of streamlining was embodied in steel by the Baltimore and Ohio in 1900 and is the first known example of a streamline train. Limitations imposed by the necessity of adapting Adams' idea to existing equipment, and failure to make recommended modifications upon the locomotive led to unsatisfactory results in test runs. Unbroken side structure of the coaches, vestibule construction, and shrouding reaching nearly to the rails — all suggesting present-day practice — were contradicted bluntly by the untouched locomotive, as the illustration shows

forced by present demands that many passenger engines today must be able to cruise at speeds approximating 100 miles per hour, and freight engines often approach the speeds conventionally reserved for passenger locomotives in the immediate past.

Streamlining has, as Mr. Beebe suggests, produced a reawakening of interest in railroad travel and the drama of railroading. Some of his photographs are of especial value in this regard, for they show clearly the tendency so to arrange the streamline shrouding of steam locomotives that the dramatic portions of the machine — the boiler and drive rods particularly — shall not be obscured. Thus the personality of the steam engine, which is after all a thing distinct and apart from Diesels and electrics, is preserved. It is proper to record here that the first application of streamlining to passenger equipment was made by the Baltimore and Ohio in 1900, when an experimental train, shown in our illustration, was built from designs of Frederick U. Adams. Its similarity, in its continuous longitudinal structure and the shrouding of the understructure, to currently accepted methods speaks well for the vision of its designer. The tests to which it was put did not show economy in power requirements over the conventional equipment of its day, probably because it ran at the comparatively moderate speed of 60 miles an hour, because cross-sectional and lateral areas were increased, and because — possibly for purely sentimental reasons — the locomotive was not streamlined.

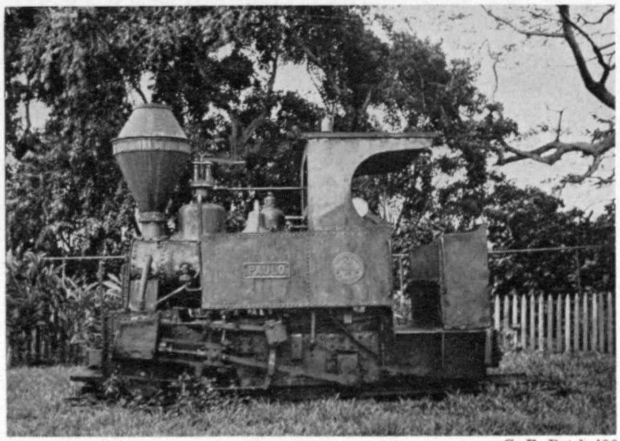
In discussing the field of application of steam motive power as compared to electrification and Diesel drive at present and in the immediate future, Mr. Beebe seems somewhat too pessimistic. As long as a generation ago, the virtues of electrification as against steam were discussed at great length, and some proponents of electrification predicted that a large percentage of railroad mileage would no longer know the steam locomotive of the past. Not only the fact that this change has not taken place but also the fact that the reduction of those estimates of future electrification to a relatively small portion of total railroad mileage is due to the continued development of the steam locomotive and the characteristics inherent in it.

While there is no doubt that Diesel power has a field of application both in switching and in high-speed passenger service, yet the developments of this type of power so far presented have not indicated that it will replace more than a small percentage of total railway steam motive power requirements.

Problems in Steel

STEEL made in vacuum provides part of the material for a coöperative attack on fundamental problems of the open-hearth process now going on in the laboratories of the Institute's Department of Metallurgy. Directed by Professor John Chipman, the investigation has as its aim the determination of scientific answers to a number of questions of basic importance in the manufacture of man's most used metal.

While steel is in the liquid state during manufacture, it is in contact with slag and with gases. The reactions which occur between these and the molten metal are the focus of the Technology study. The main reactions are those having to do with the removal, by oxidation, of impurities in the raw materials — pig iron and scrap.

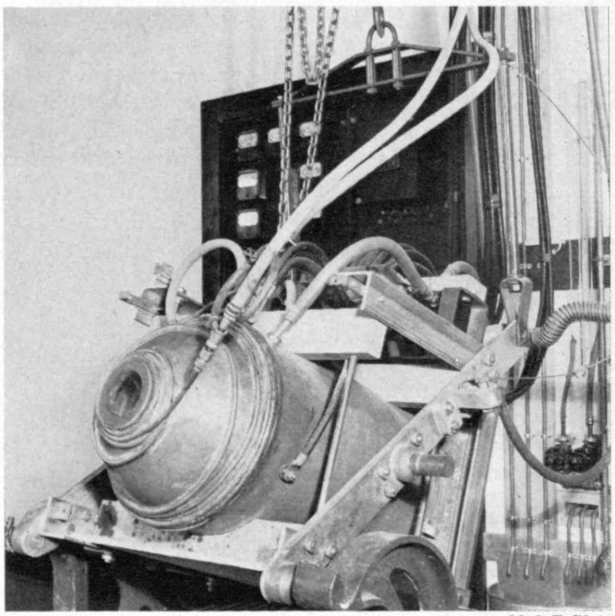


C. E. Patch, '02

Reminiscent of the beginnings of sugar in Hawaii is this, the oldest locomotive on the island of Kauai

The impurities, principally carbon, silicon, and phosphorus, rise from the melt to the slag floating on the surface, the oxidizing agent being iron oxide, part of which comes from the oxidation of the charge during melting and part of which is added in the form of iron ore. The slag is a mixture, then, of iron oxide, lime which is used to eliminate phosphorus from the melt, silica, and half a dozen other lesser materials. Removal of the principal impurities from the liquid steel to the liquid slag floating upon it is not an even process, for the silica, which is derived from the silicon — an incidental impurity in all the materials going into the furnace — comes out relatively fast during the early stages of manufacture. Removal of the other two main impurities — carbon and phosphorus — however, is slow, and its rate determines the speed of manufacture. A heat now requires from 10 to 14 hours, a considerable portion of which — from 30 minutes to three or four hours — is used up in the removal of these two impurities. To determine whether this time can be cut is one of the objectives of the Technology researchers.

Not only the speed of manufacture but also the quality of the product is contemplated in the study. Once iron oxide has been got into the metal to serve as an oxidizing agent in the removal of impurities, one of two methods may be used in practice to solidify the metal. Each of these is conditioned to a great degree by the amount of iron oxide present. The first method involves the addition of a little manganese and the pouring of the molten steel into molds, where it solidifies, evolving much gas from the reaction of the carbon and the iron oxide. The resultant ingot is full of blowholes made by the gases, and these are subsequently welded together by forging or rolling. The steel thus made — rim steel, as it is called because of the fact that the ingots harden first in a rim around the inside of the mold — is of low-carbon grade which welds readily.



M. I. T. Photo

The vacuum induction furnace, tilted three-quarters of the way to pouring position in order to display its incasing drum and dome. Water, vacuum, and power lines also may be seen

The second method of solidification consists in adding to the molten metal some substance more reactive than iron in order to reduce the iron oxide. Silicon, aluminum, titanium, and zirconium are thus used. Molten steel so treated is quiet in the molds, without the effervescence of rim steel, because little gas is evolved, since the iron oxide has been reduced. It is hence called killed steel. High carbon content and alloy steels are thus made. The quality of rim steel depends upon the iron oxide content of the liquid metal because that determines the rate of elimination of gases and hence the location and size of blowholes. The quality of killed steel likewise depends upon the amount of iron oxide present because that determines the amount of deoxidizing agents which must be added, and because the deoxidizing process introduces into the steel certain amounts of oxides of other metals. The distribution of iron oxide thus has bearing on the quality of both finished products.

Cutting down the time of manufacture and securing methods of quality control both hinge upon an understanding of the mechanism of the removal of carbon from the steel. This is usually the slowest of the removal processes which have been mentioned. The rate at which it proceeds depends upon several steps, the slowest of which determines the speed of the whole chain. Of the series, the two major steps are the diffusion of iron oxide from the slag down into the metal and the subsequent bubbling out of the carbon in the form of carbon monoxide gas. Which of these two controls the over-all rate of the carbon removal process is a question. If one is fast and the other slow, the faster one probably goes as far as it can and waits for the other to catch up. For this reason, study of each process in the absence of the other — that is, of diffusion without regard to the gas reaction, and vice versa — is expected to be helpful. The slag reaction is now being investigated; the other will be considered later.

From a purely scientific point of view quite apart from its practical implications, the study has interesting bearing on the general theory of solutions. The chemical laws governing the behavior of the solution of various materials in the liquid steel and of another set of materials in the slag — about both of which present knowledge is slight — are of importance in that they may contribute to this theory.

The empirical situation of open-hearth steelmaking appears, for instance, in the rule-of-thumb methods now used to determine the temperature of a melt. One way of doing so is to thrust a steel rod into the furnace and judge the temperature there by the rate at which, and the way in which, the rod is melted. Such methods are enforced upon the steelmaker by the lack of refractories tough enough to protect thermocouples against the intense heat of the process and the erosive action of the slag. Experimentation with various types of thermocouple and with methods of protecting them by refractories is incidental to the Technology program.

When it is desired to determine the iron oxide content of a sample directly, a metal must be used whose carbon content is so low that virtually no carbon monoxide gas will be formed during diffusion of the iron oxide and subsequently lost by bubbling out, thus eliminating oxygen. For direct determination to be *(Continued on page 185)*

The Air and the Jungle

How Plane and Camera Combine to Map Impenetrable Regions as the Search for Oil Proceeds in New Guinea

By Harold G. Crowley

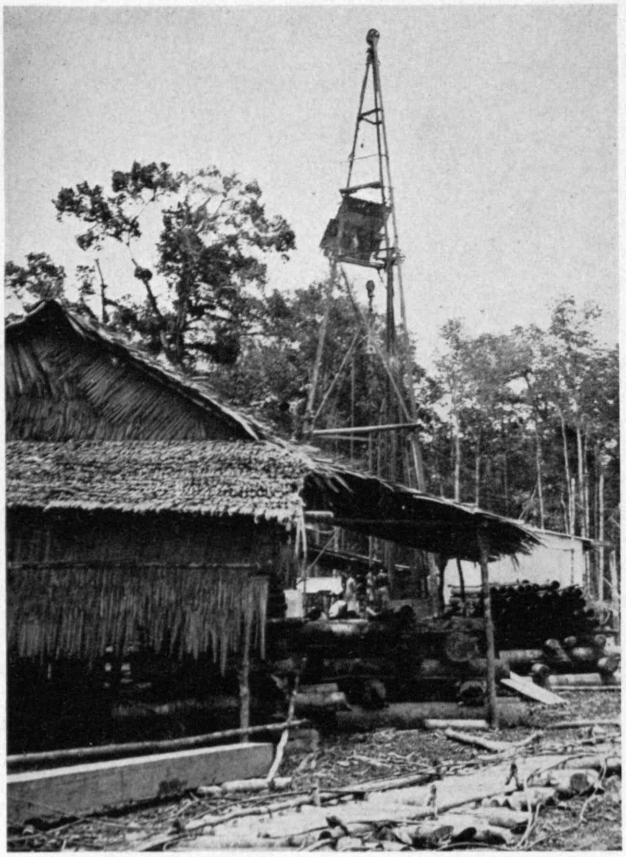
MAPPING a tropical jungle area from the air has distinct advantages over trying to do the task on the ground; from the air one can expect at least to be able to see the forest in spite of the trees. Yet even if the topographer could simply fly across and take his pictures, and never have to establish bases in the jungle, never have to dodge snakes and crocodiles, never have to cope with malaria, spoiled food, torrential gales, swirling rivers, snarling natives, and so on — if, in short, he had to make no contact with the jungle itself, still one great and nearly constant hazard would remain to keep his life from becoming a glad, sweet song. This hindrance is that of poor visibility — from cloud formations which develop suddenly while the plane is climbing, so that photography has become impossible by the time sufficient elevation has been reached; or from long periods of perverse weather which may hold the mapper fretting in his jungle camp while weeks plod slowly by.

Of jungle areas, New Guinea, the locale of this narrative, has a full share. Sprawling and basking under the equator, it is the world's second largest island; its approximately 310,000 square miles are roughly equivalent to five of our New Englands. The climate, ranging from the worst malarial regions known on earth, on the island's southeast coast, to perpetual snow on the 15,000-foot mountains of the great central ranges, exhibits the greatest imaginable diversification of flora and fauna. Here are peoples unseen and little known, animals that have been started far back on a quite different evolutionary tangent, birds of rainbowlike hue and exotic plumage, rivers navigable for hundreds of miles yet with terrific tidal bores, forests and plains nurtured by equatorial sun and the world's second heaviest rainfall.

Above. *Dwarfed by the surrounding jungle is an oil-drilling camp on the Kikori River as seen by the nine-lensed camera from 1,000 feet. Scale, 1:3,336*

Exploration for petroleum in portions of Papua, the southeasterly political division of New Guinea, was made possible in 1936, when the Papua Oil Development Company, Ltd., an Australian subsidiary of the Shell Company of Australia, Ltd., in turn an affiliate of the powerful Royal Dutch Shell group, received final authorization from the Australian and Papuan governments to investigate the region.

The area which was initially allotted to the Papua Oil Development concern consisted of 5,400,000 hectares, or about 20,000 square miles. The Australian Shell company's only serious competitor received



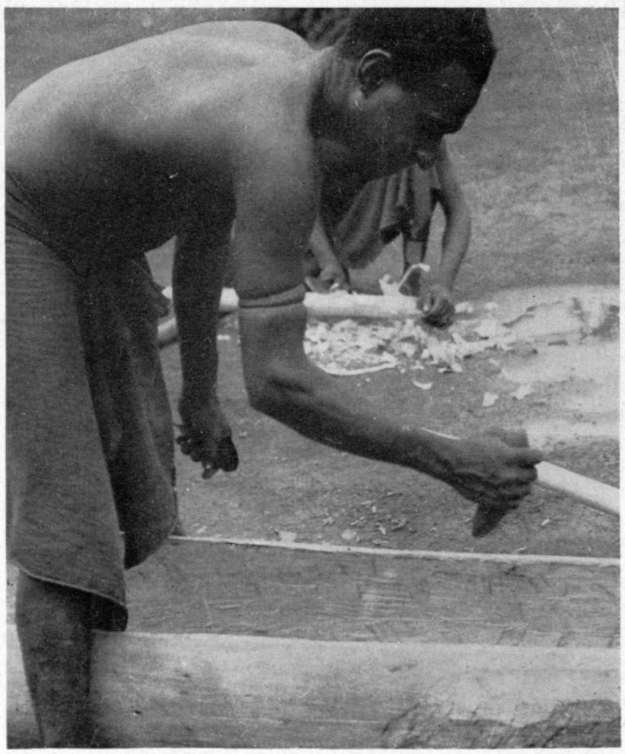
a similar large area, and several small independents obtained rights to proportionally small regions. This initial area, bounded by the Gulf of Papua throughout its southern border, was comparatively easy of access through the large mouths of many rivers, while some other competitive concessions could be entered only by passage up rivers and through the Shell area. All the concessions stipulated that the geologic samples and interpretations and all maps and triangulation, both air and ground, should be made available to government in due course. Other conditions of these leases had to do with the working, feeding, and general welfare of a large number (600) of an extremely low type of native labor, the bonding for emigration of a highly cosmopolitan technical staff, and the arranging for adequate policing and suitable hospitalization for all. The most important part of the leases, however, was the reduced-area clause, which provided that at the end of one year (under certain conditions, extended for another year) the companies should relinquish their exploratory work throughout the major areas and concentrate on smaller tracts of their selection.

Since for this entire region there were no topographical maps worthy of the name and since most of the country is nearly devoid of all contour, it was decided to work from the air, using an air-mapping camera which would cover the maximum area with the least possibility of gaps and misses caused by navigational errors in the flying. The first air work to be done was of 6,000 square miles in a continuous section, 200 miles long by 30 miles wide. Four flight lines the long way of this rectangle would provide sufficient coverage.

The crucial point in the program was the choice of sites for bases. In a region where rain is nearly continuous, advantage must be taken of any small bit of cloudless sky, and this advantage is best obtained if the plane can be based as nearly as possible in the center of the area to be flown. The reason is obvious: The area can be covered piecemeal fashion when small patches of clear sky allow. Bodies of water to permit the use of an amphibian are plentiful throughout the region. Considerable thought was given to building at least one drome, but the idea was finally abandoned because of the heavy rainfall. Tropical airdromes in districts of continuous rain are costly in maintenance and unsatisfactory in use, for gullies and washouts render them dangerous and very frequently inoperative. That the rivers in such country are little better may be judged by the fact that the first plane acquired by the company had been cracked up and had sunk following the striking of an object during a water landing. Luck was good in this accident, for it was without fatality even though it occurred in a fast flowing, muddy, swirling jungle river abounding in crocodiles, snakes, and driftwood of all sizes, shapes, and degrees of submersion. This condition is a very real, constant, and highly hazardous menace and, together with the complete calm and glassy water condition offering so much worry and grief to seaplane operation, constitutes the most probable source of trouble to those who would map jungles from the air. The possibility of weather hazard is not high because the weather, though very bad and with heavy, nearly continual rain, always acts in a reasonably predictable

STEEL AGE AND STONE AGE MEET IN NEW GUINEA

Above. *A Conrad drill down to 7,000 meters on the Kikori.*
Below. *A native hacks at his dugout with a stone adz*



manner. We did not encounter any winds of magnitude enough to damage a moored seaplane, nor did we find any thunder or cumulus cloud too high to fly around or cloud layers too thick to fly through.

This first plane was a Sikorsky S-38, a twin-engined, ten-year-old amphibian of not particularly brilliant performance. It had not proved entirely satisfactory not only because of low pay load and slow rate of climb but primarily because of slow take-off and attendant long take-off runs, with the possibility of striking nearly submerged driftwood somewhat proportional to the length of the run.

The second plane was selected for its high performance generally and its extremely quick water take-off principally. It was the American-built Grummann G-21 amphibian. This ship will get off smooth salt water in a dead calm with load right up to the legal limit (or considerably over this limit) in 10 or 12 seconds, a time interval corresponding to a distance of only 300 or 400 yards. The short distance ahead is always in continuous and easy vision. This ship also has a very high rate of climb, an extremely important characteristic for mapping work, especially in country where mapping weather is fortuitous and always of short duration. It accomplishes a tremendous saving in the time required to cover a large region.

THE SERVANT PROBLEM IN ANTIPODAL TERMS

At Port Moresby a house cook (on his day off and rigged out for dancing) is admonished by his employer to be home for the evening meal

A camera meeting the requirement of wide coverage with resulting reduced possibility of gaps because of navigational errors is the German nine-lensed machine built by Photogrammetrie G.m.b.H. of Munich. This precision instrument, weighing about 100 pounds and thus capable of being installed in flight by one man, is fully automatic, with timing interval controlled electrically by current from the plane's starting accumulators. A red warning light shows five seconds before exposure time, and the operator then so adjusts the camera with its leveling bubbles and the pilot so flies the machine that the resulting exposure will show no tilt of camera axis from the vertical. The optical system is of one central and eight radially arranged lenses, all of a focal length of 5.35 centimeters. Prisms before the eight circumferential lenses are designed to record the terrain from the edge of the central vertical picture outward to such an extent that the included angle of the system is 140 degrees. (The best of the single-lensed cameras will include not over a right angle.)

A roll of film 18 centimeters wide and 25 meters long is used, and at the normal forward overlap requirement of 75 per cent this amount of film will give about two hours, or about 125 exposures, corresponding to about 300 miles of strip. Should continued mapping weather then prevail — an extremely unlikely happening in New Guinea — and should it be desirable to continue photographing, the old magazine can be removed and a freshly loaded one substituted during the interval between exposures. It is not necessary, then, to turn and pick up the old flight line for a new start. This ready changing allows of great timesaving. Development of the film results in negatives 18 centimeters square with a central vertically photographed portion and eight radial and disconnected obliquely photographed portions. A transforming enlarger then distorts these obliques into a vertical continuity, with the resulting print a truly vertical picture 25 centimeters square. The short focal length of 5.35 centimeters gives, from the working altitude of 4,000 meters, a natural scale of 1: 80,000.

The use of this small scale and high terrain coverage with the wide-angle camera was felt justified by experience obtained in near-by parts of the Dutch East Indies by various oil development combines. The small scale and large angle are especially fitted for use over terrain with hardly any relief — the Papuan concession is almost continuously less than 100 feet above the sea. The large angular coverage results in great stereoscopic clarity despite the small scale, with even the smallest of changes in elevation standing out very boldly. The short focal length tends toward greater depth of focus in individual pictures. Furthermore, the amount of laboratory work is reduced enormously. The camera is not provided with a view finder, but it was found that acceptable results could be obtained for the photography by the use of the drift indicator fitted to the plane.

We divided the first long strip to be mapped into three sections, each 67 miles in length, and then proceeded to base first on the bank (*Continued on page 182*)

Factory or Cathedral?

Research into the Spinning of Molecules Must Reckon with the Architecture of the Microcosm in Order to Make the Most of Artificial Yarns

By Edward R. Schwarz

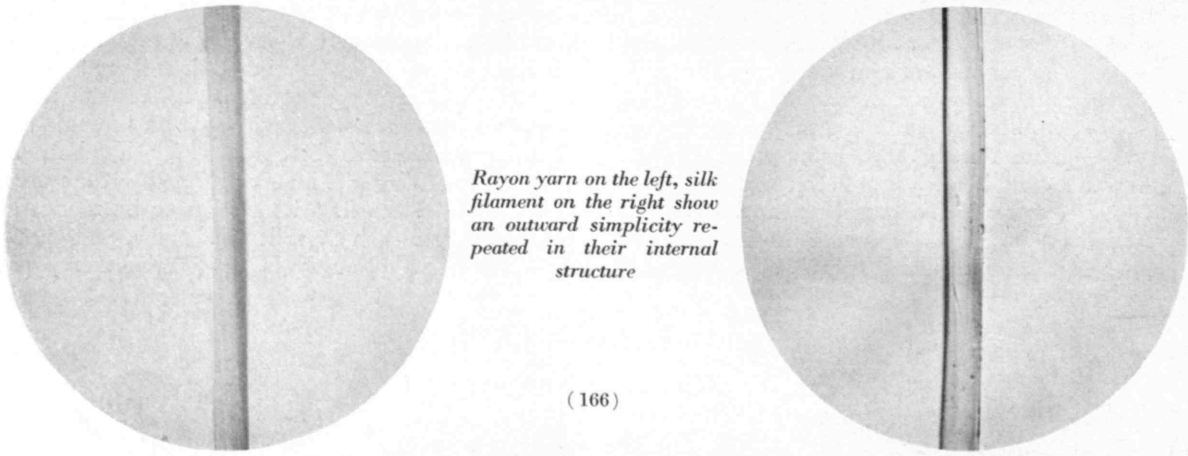
A PREDICTION made 273 years ago by Robert Hooke has been fulfilled in our times more perfectly than he could possibly have foreseen. Sometime prior to 1665 Hooke built himself a microscope and examined, among other things, a number of textile materials. As a result, we have from his tests not only detailed and penetratingly keen descriptions of his observations but some of the finest micrographs of fiber and fabric ever made.

Said he, in "Micrographia": "A pretty kind of artificial Stuff I have seen, looking almost like transparent Parchment, Horn or Isinglass and perhaps some such thing it may be made of . . . . to the naked eye, it looked very like the substance of the Silk. And I have often thought, that probably there might be a way found out, to make an artificial glutinous composition much resembling, if not fully as good, nay better, than that Excrement or whatever substance it be out of which, the Silk-worm wire-draws his clew. If such a composition were found, it were certainly an easy matter to find very quick ways of drawing it out into small wires for use. I need not mention the uses of such an Invention, nor the benefit that is likely to accrue to the finder, they being sufficiently obvious. This hint, therefore, may, I hope, give some ingenious inquisitive Person an occasion of making some trials, which if successful, I have my aim, and I suppose he will have no occasion to be displeased."

Had Hooke's microscope been magically transformed into a time-annihilating telescope focused sharply on our own day, he could hardly have described more precisely the present development of synthetic fibers. Gazing through his lenses he might well have been seeing a procession of scientists who have made the trials and in so doing have not only achieved his aim but added immeasurably to the pleasure and profit of the world. His foresight is the more noteworthy because, in addition to the generalities of his prediction, he far anticipated in his comments the organic chemist and the modern conception of long-chain molecules of high tenacity and of the closely knit, fine structure of both natural and artificial filaments. That he visualized the present-day chemist's difficulties with many fibers because of their imperfect resistance to heat; that he could have known how bothersome the thermoplastic properties of synthetic resins would be; or that he was so long ago aware of an eventual solution to the problem within the last few years is very doubtful. Nevertheless, he did recognize what has been too infrequently appreciated by the textile chemist — the fact that the method of arrangement of the molecular structure of the fiber is the all-important consideration. The production of really satisfactory artificial fiber is fundamentally a matter of molecular pattern.

Hooke continues: "As for the *tenacity* of the substance of the Flax, out of which the thread is made, it seems much inferior to that of Silk, the one being a *vegetable*, the other an *animal* substance. And whether it proceed from the better concoction or the more homogeneous constitution of *animal* substances above those of *vegetable*, I do not here determine; yet since I generally find that *vegetable* substances do not equalize the *tenacity* of *animal*, nor these the *tenacity* of some mineral substances; I am very apt to think that the *tenacity* of bodies does not proceed from the *hamous* or *hooked* particles as the *Epicureans* and some modern philosophers have imagined; but from the more exact congruity of the constituent parts, which are more contiguous to each other, and so bulky, as not to be easily separated, or scattered, by any small pulls or concussion of heat."

That Hooke was not alone in his ideas upon the construction of synthetic fibers is evidenced by a passage from the famous French naturalist and physicist, Réaumur, who says, in "L'Histoire des Insectes": "Silk is only a liquid gum which has been dried; could we not make silk ourselves with gums and resins? This idea would appear at first sight fancied; is more promising when examined more closely. It has already been proved that it is possible to make varnishes that possess



Rayon yarn on the left, silk filament on the right show an outward simplicity repeated in their internal structure

the essential qualities of silk. China and similar varnishes are unaffected by solvents, water has no effect on them, the greatest degree of heat to which our fabrics are exposed could not change them. If we had threads of varnish, we could make them into fabrics which, by their brilliancy and strength, would imitate those of silk, and which would equal them in value, for good varnishes when properly dried have no smell. But how can we draw out these varnishes into threads? We cannot, perhaps, hope to draw out these threads as fine as those obtained from silk, but this degree of fineness is unnecessary, and it does not seem impossible either to spin them as fine as natural silk, when we consider to what extent art may be carried."

Modern chemistry may sometime be able to treat short bits of waste silk, wool, or cotton in such fashion that their constituent elements may be reassembled into filaments of properties equal or superior to those possessed by the original material. Rayon, as we know it, is a beginning adaptation of this sort for cotton — or for cellulose in general. Further experimenting with other materials only this year has resulted in filaments fine as the finest silk. Réaumur was not too optimistic when he speculated "to what extent art may be carried."

Daily it becomes more evident that the scientist must learn more of architecture to obtain a basis of information for his spinning of molecules into yarns. The molecular architecture of fibers is as important as their chemical composition. One has only to examine the structure of the natural fibers to find that there is a striking resemblance between the combining of long-chain molecules (one author calls them "molecular chain gangs") into fibers and the assembling of these fibers into yarns. In cotton, for example, glucosidic residues formed of joined rings made up of carbon, oxygen, and hydrogen atoms link into chains which lie parallel with one another in miniature fibers known as fibrils. Although composed of what an ordinary mortal thinks but a pinch of powder and a puff of gas, they form chains stronger than any anchor chain ever forged.

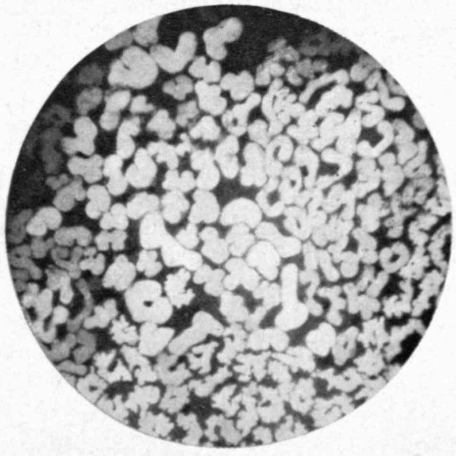
Just how these fibrils are formed is still something of a mystery, but certain evidence hints they may consist of extremely small particles. The possibility that inorganic materials, such as clay, under suitable conditions may form filaments of surprising strength and flexibility has been noted in the laboratories of the Institute by Professor Ernst A. Hauser of the Department of Chemical Engineering.* Further research may lead to information as to how cellulose particles behave in forming fibers.

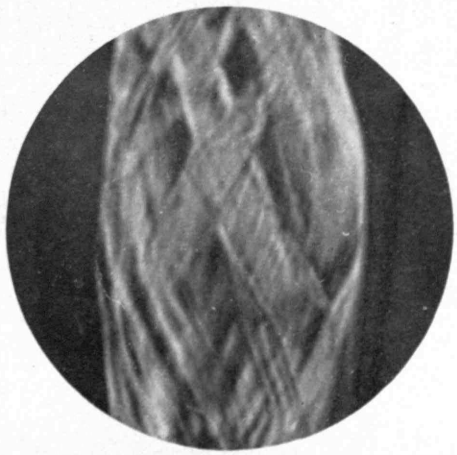
* For a detailed discussion of this research, Review readers are referred to the article, "Studies on Gelation and Film Formation of Colloidal Clays. I," by E. A. Hauser and D. S. LeBeau in the *Journal of Physical Chemistry*, Volume 42, Number 7, October, 1938, page 961.

However the fibrils are composed, they can be shown by x-ray diffraction analysis to be built of units having a definite scheme of architecture. In forming the molecules — the raw material from which man hopes to spin synthetic fiber — it is not enough to duplicate the chemical composition of some natural fiber by weight. This has been done in the synthetic fiber derived from casein and known as lanital, whose composition is shown in the following tabulation to be almost identical with the average composition of wool:

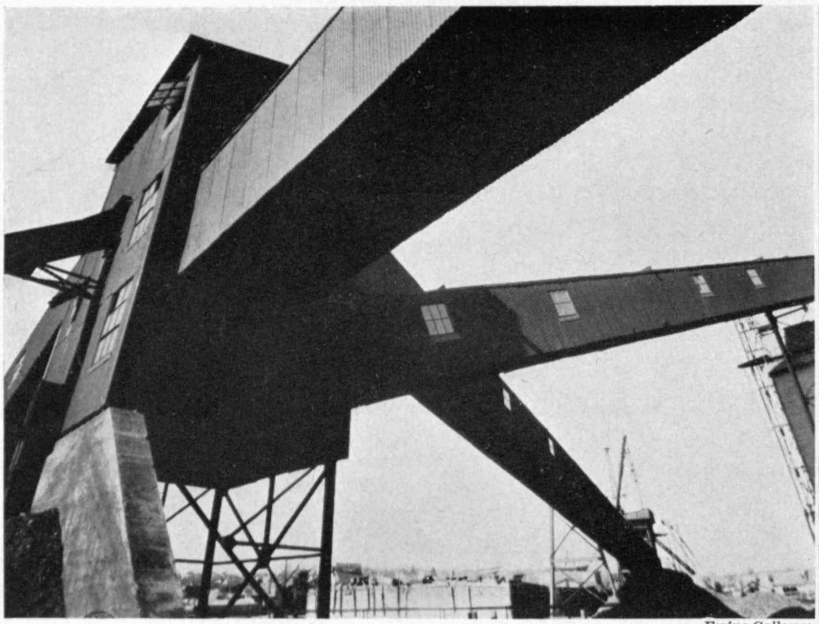
Elements	*Wool*	*Lanital*
Carbon	49.25	53.00
Hydrogen	7.57	7.00
Oxygen	23.66	23.00
Nitrogen	15.86	15.50
Sulphur	3.66	0.70
Phosphorus		0.80

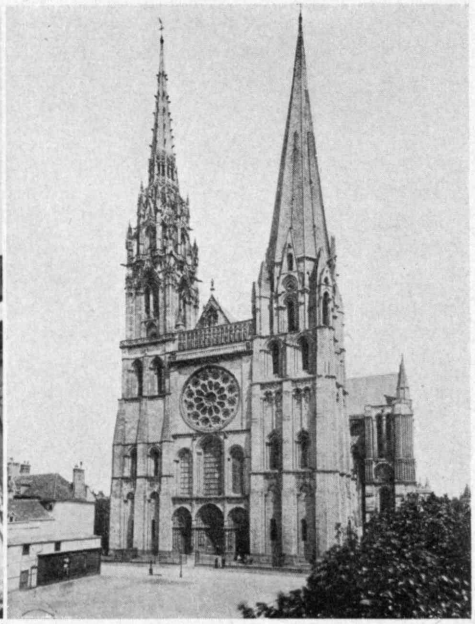
But wool is still an outstandingly different fiber. It grows slowly and is essentially made up of thousands of elongated cells, each almost submicroscopic in two of its dimensions, packed together like a bundle of fagots. In this respect wool differs in structure from silk, which is extruded rapidly by the silkworm. The various vegetable fibers also grow slowly, and while their development is complete over perhaps a somewhat shorter period than is true of wool, they nevertheless are the result of complex functions of specialized organisms in the plant. Nor do the various plants behave alike in the production of the fibers. Each fiber was intended by nature to serve a particular purpose in the plant of which it forms a part — whether as a protective covering for the seed or a means of transfer of the seed from place to place in order to insure abundant growth; as a reinforcing rod to hold erect the stem of the flax plant or a rib stiffening the fleshy leaf of one of the many plants which give us cordage fibers. Each fiber is therefore designed specifically to accomplish certain purposes, and some master builder must originally have written detailed specifications of exactly the structure which shall be used in each case. For instance, the extreme toughness, flexibility, and yet the softness of cotton are in sharp contrast to the stiffness, smoothness, and brittleness of flax and hemp. Even for rayon the speed at which the filament is formed is an important factor in the production of a satisfactory filament. If the spinning solution of viscose is coagulated or hardened rapidly, a cross section of irregular shape will be formed. On the other hand, if the rate of hardening of the filament is relatively slow, a more uniformly round, smooth filament will result. Thus, there have arisen a great many different outlines for the cross-sectional form of





Left. *Cross sections of rayon.* Right. *Fibril into fiber — the interlaced structure of cotton*





Ewing Galloway

the various viscose fibers. Less variation is found in the acetates, but even here there are to be noted both bilobed and trilobed cross sections. The difference of a fraction of a second in the coagulation rate of the spinning solution is a matter of great importance and shows on a small scale something of the variations which are produced in nature over longer periods.

Because of the mode of its production, silk more closely resembles a synthetic filament, and many of the earlier synthetic fibers were therefore known as artificial silk. True, artificial silk, natural silk, and wool all have in common the fact that they were synthesized somehow from vegetable matter: wool, from pasturage; silk, from a diet of leaves; synthetic filament, from cotton or wood pulp. In the last analysis, therefore, all of our fibers — natural or man made — are products of solar energy, for without the sun, the plant growth of which we speak becomes impossible. We clothe ourselves, decorate our dwellings, and engage in an ever increasing range of mechanical usages with fibers, yarns, and fabrics composed ultimately of sunbeams.

The textile manufacturer has long known three things about yarn: Other things equal, the best yarns are produced from fibers which are long, which are fine, and which are perfectly parallelized. Fineness, length, and parallelism are likewise desirable in the molecules which compose not only natural but synthetic fibers. Largely because of these facts, no wholly satisfactory process for converting natural fibers to synthetic filaments has thus far been developed. Sometime, however, a method will be discovered for breaking up cellulose into undamaged molecules and for arranging them substantially parallel with each other and with the axis of the fiber. A better rayon will be the result.

The present rayons are formed from degraded (broken up) or modified cellulose molecules, and x-ray diffraction research shows that the molecular orientation is largely random. Efforts have also been made to dissolve silk and to spin the solution into filaments. The result is much like grinding up a porterhouse steak into hamburgers. However beautifully formed the resulting "wimpy" and however carefully broiled, it would fool no one into thinking he was eating a planked steak. And yet the essential ingredients are the same. Again it is a matter of architecture, a matter of arrangement of components, a matter of structure. To synthesize a cotton or a wool fiber by simply squirting a solution through a spinneret is like dumping the correct quantities of steel, timber, cement, sand, and stone into a giant concrete mixer and expecting to pour out a finished Radio City. Skill in structural arrangement is needed. In an architectural masterpiece there must be the effort of specialized craftsmen. In fibers there must be the specialized functions of many cells, glands, and nerves.

The synthesist is not discouraged. Each day new experiments furnish new data. In the laboratory fabrics are being burst open, rubbed to pieces, roasted, stewed, stared at by electric eyes, lighted by artificial rainbows, faded by ultraviolet light, sliced open by microtomes, and torn apart by testing machines. Each bit of fact leads to a more perfect interpretation of the facts that have preceded. As more knowledge of the nature of the service required of a particular textile is obtained, it becomes more nearly possible to design a structural plan and specifications for a fiber to meet the need. Here lies the future of synthetic fibers.

It may seem trite to say that although made of the same materials a cathedral is strikingly different in appearance and purpose from a factory. The difference, in other words, is in architecture, not in substance. The difference in architecture in each case is due to the need for a building intended to perform a certain function. Now textile fibers are the raw materials for textile yarns and fabrics because of man's ingenuity in adapting them to a purpose for which they were not originally intended. It is quite unlikely that plants, animals, and insects were created expressly to furnish fibers for cordage and cloth. Our utilization of naturally occurring fibers has been much as if an (*Continued on page 189*)

Automobile Ancestry

Nearly Forgotten Forebears of Streamline 1939

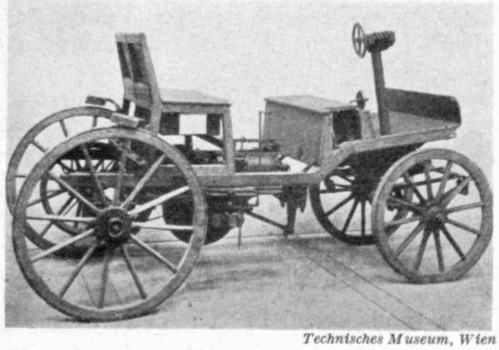
By L. L. Thwing

How a Jesuit Missionary-Engineer Won Chinese Imperial Honors — The King of Holland's Car — Rope Drive and Three-Dollar Gasoline

SWIFT and svelte today, the automobile has evolved in our time at such a rate that even now the horseless buggy of the 1890's is a conspicuous and at times ludicrous rarity. It is no more than natural, then, that still earlier forebears of the 1939 streamline job should have been well-nigh forgotten and that the comparative antiquity of the vehicle should be a matter of surprise. Two self-propelling conveyances here to be discussed will high-light the situation. One of these, the first working model of a *steam-driven* automobile — long before the first steam engine, as we commonly understand the word — was constructed in the 17th Century by Ferdinand Verbiest. In the mid-19th Century, Siegfried Marcus built, if not indeed the first, one of the ancestors of the full-sized *gasoline* car, which bore a remarkable resemblance to the automobiles of the early 20th Century. One of his cars is said to have been sent to the United States about 1875, and another is now in the Technisches Museum in Vienna. The latter is the oldest gasoline-driven automobile in the world.

Verbiest's success with his model steam car is well authenticated by both direct and circumstantial evidence. As a priest — a Jesuit missionary to China — he was not at liberty to assume the title "engineer," but as a designer and builder of artillery and astronomical instruments, he is entitled to be so named. In 1668, while still in China where these devices and the automobile were constructed, he wrote a book describing them, on which was based the "Astronomia Europaea," published in 1687, a rare book which the writer has been unable to consult. This description of Verbiest's steam "Waggon," taken from Du Halde's "Histoire de la Chine," 1741, is presumably a translation of Verbiest's Latin text, in which the wagon is said to have been built in 1665:

> They [the Jesuits] caused a Waggon to be made of light Wood about two Foot long, in the middle of it they placed a Brasen Vessel full of live Coals, and upon that an Æolipile [boiler], the Wind of which came through a little Pipe upon a sort of a Wheel made like the Sails of a Windmill; this little Wheel turn'd another with an Axle-tree, and by that means set the Waggon in Motion for two Hours together; but lest room should be wanting to proceed constantly forward it was contriv'd to move circularly, in the following Manner.
>
> To the Axle-tree of the two hind Wheels was fix'd a small Beam, and the end of this Beam another Axle-tree, which went through the Center of another Wheel somewhat larger than the rest; and according as this Wheel was nearer or farther from the Waggon it describ'd a greater or lesser Circle. [A following paragraph describes how this device was applied to a "little Ship."]



Technisches Museum, Wien

Clear vision, erect posture, ample ventilation — the requisites of automotive safety — were well provided in Siegfried Marcus' second automobile, built in 1875

Verbiest's use of the word "they" is not a disavowal of his invention; it is probably a sort of editorial "we." Were we to reconstruct his turbine, there would be a small steam boiler connected to a "little Pipe," through which the steam impinged on the blades of a turbine rotor, "a Wheel like . . . a Wind-mill." That is, the direction of the steam jet was more or less parallel to the axis, not at right angles. By use of a large rotor and a pair of reducing gears, the speed of the car could have been maintained within workable limits. That the rotor was like a windmill does not necessarily mean that it had four cloth sails.

The wagon is not so easy to reconstruct. Rhys Jenkin's brief description in "Motor Cars," 1902, indicates that the steering wheel was carried on a swiveling arm. Jenkin's text implies that his description was taken directly from Verbiest's own account, but to us it seems probable that both the rear axle and the fifth wheel — or rudder — swiveled independently. The fifth wheel swung the rear axle, which in turn swung the car.

We cannot be entirely sure that this primitive turbine was Verbiest's original conception, as he may have been familiar with Giovanni Branca's "Le Machine," published in Rome in 1629. An illustration in this book shows a steam jet from an æolipile in the form of a human head — as most of them seem to have been — impinging on a small paddle wheel, the jet being at right angles to the axis. If Verbiest knew of this "invention," he did not copy the details in his own rotor. He says that as a working model, his wagon ran "for two hours together," a statement which has a convincing sound, and it is reasonable to assume that he meant that it ran for two hours continuously. There is one nontechnical commentator on Verbiest's achievement, the Abbé Huc, who in "Christianity in China," 1858, Volume 3, page 135, asks: "Who knows whether the first locomotive and the first steam-boat may not have per-

formed their functions in the gardens of the Imperial palace at Pekin. . . ?" He also quotes Verbiest's own comment on his experiment: "The motive power of steam being given, it is easy to make many other applications of it." Verbiest wrote these words in, or before, 1668. Nearly a century was to pass before the Newcomen steam engine was improved to give rotary power.

Concerning the able Jesuit we have information from other sources, the "Bibliothèque des écrivains de la compagnie de Jésus" and "Lettres édifiantes et curieuse." Verbiest went to China in 1659 and was given the Chinese name of Nan-hiai-jin. At first both he and his fellow Jesuits were unpopular, but when war threatened, Verbiest revolutionized Chinese designs and methods of cannon making to such advantage that he became a favorite of the Emperor K'ang-hi and was made royal astronomer. His monograph on cannon making — in Chinese and illustrated with 40 plates — is in the Bibliothèque nationale at Paris. In addition to cannon making, he designed and built new instruments for the Royal Observatory near Peking. Verbiest died in China in 1688 and was given the highest honors at his funeral, including a eulogy by the emperor himself. Whatever the actual performance of his steam wagon, there can be no question of its priority.

Previously, in Europe, Mother Shipton had prophesied horseless carriages, and in 1698 Denis Papin is said to have built a working model of a steam carriage. The first thought of inventors of both steam and internal-combustion engines has been, with few exceptions, to apply them to wagons or boats. Cugnot, the French artilleryman who, in 1771, built the first full-sized vehicle that can really be called an automobile, intended it to haul cannon. This steam tractor, the oldest automobile in existence, is still preserved in the Conservatoire des arts et métiers in Paris. In England about 1830 the steam road omnibus appeared and its advent is today reflected in the colored prints of that period. In France, almost a century after his compatriot's work with the steam engine, Lenoir invented the gas engine and in 1862 drove a car powered by internal combustion from Paris to Joinville-le-Pont, a distance of some eight miles. In his own country he is recognized as the inventor of the automobile, but there is much question whether Lenoir's engine fuel was illuminating gas or gasoline.

The foregoing phases of automotive history have been told many times and need not be expanded here. The achievements of Marcus are not so well known. Siegfried Marcus was an Austrian who served his apprenticeship with the well-known Berlin firm of Siemens and Halske. In 1860 he opened his own machine shop in Vienna and began to experiment with gasoline engines at a time when the fuel could be purchased only at drugstores and cost about three dollars a gallon. Marcus' engines and all gasoline engines of that period of development bore no resemblance to our present models. They were non-explosive, a slow-speed type whose card would closely resemble a steam engine card. This fact should be held in mind when considering the possibilities of Marcus' automobile.

At a time when other men were experimenting with steam carriages, he seems to have been the only one to work with gasoline-driven cars. Marcus' first experimental vehicle was an engine on a flat car, as were Peter Cooper's locomotive and the first steam automobile to make a mile a minute in America. Marcus' car was a two-stroke, atmospheric-type engine, set on a large handcart. The rear axle and crankshaft were one and the same. The connecting rod was in two parts, with a stiff, spiral spring to absorb some of the inequalities of thrusts from the cylinder. Because there was no explosion, these kicks were mild as compared with those of a modern high-speed motor, and there would have been a heavy flywheel for continuity of power. The spiral-spring shock absorber probably functioned better than would now be expected. As the engine was connected directly to the driving axle without intermediate clutches, it was necessary to lift the rear wheels and spin them to start the engine. For ignition the car had a high-tension magneto, later patented by Marcus. Other details are lacking, as is the car itself, but fortunately we have the testimony of a passenger, given here in rather free translation:

> In the year 1865 Marcus invited me to test his first automobile. . . . One should not think that Marcus had only to crank his motor and start away from his . . . workshop. To test the vehicle we had first to find a street as dark and deserted as possible. . . . Arriving there we tried to start the engine, which was not at all easy, but at last it began to work with much spitting and we were successful in moving the car and drove for a distance of about 200 meters with Marcus at the wheel. Then the engine skipped and finally stopped and our driving test for the day was finished. A mechanic from the shop had to furnish the motor power to bring the car back.*

Had Marcus been a typical inventor, he would probably have neglected his business, put all his energies into improving his automobile, and died poor. But he seems to have felt that his opportunity lay in building gas engines and developing some of his 38 other patents. Accordingly it was ten years before he produced another car, but we may assume that he had experimented in the meantime. This second car (page 169), built in 1875, shows many improvements. Fortunately it is still in existence and is one of the most valuable exhibits in the Technisches Museum at Vienna. Here we may note that Marcus' car now had a four-stroke motor with a rope drive from the engine to the rear axle. This rope drive was provided with an idler-type belt tightener in lieu of a clutch. The engine had a slide intake valve, while the exhaust port had a piston valve of surprisingly modern design. The gasoline was vaporized — or carburized — by a patented carburetor using rotating sprayer brushes which dipped into a reservoir of gasoline. Steering was by worm and wheel, as in modern cars. The operator could start the motor without leaving the car, by means of a lever and train of gears. The speed of the engine was controlled by a handwheel conveniently located near the driver's seat. The Viennese claim, with some reason, that this car "in its entirety is much superior to the first cars built by Daimler and Benz, ten years later." Marcus constructed three cars of this model. It is said that one of them was sold to the king of Holland and another was sent to America. (Marcus had a brother in (*Concluded on page 190*)

* Albert H. Curjel: "Siegfried Marcus," Technisches Museum für Industrie und Gewerbe, Wien.

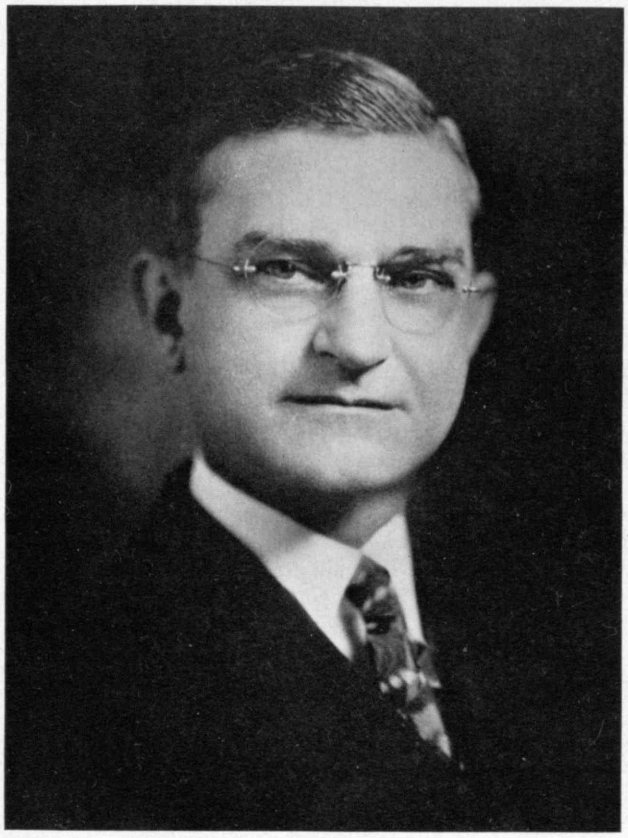
THE INSTITUTE GAZETTE

PREPARED IN COLLABORATION WITH THE TECHNOLOGY NEWS SERVICE

The Corporation

THE election of Vannevar Bush, '16, now President of the Carnegie Institution of Washington, to life membership on the Institute's Corporation and that of Charles R. Hook, President of the American Rolling Mill Company, to special term membership for five years were announced by President Compton on January 4, following the Corporation's first meeting of the year.

The election of Dr. Bush assures his continuing valuable participation in the administrative affairs of the



CHARLES R. HOOK

Institute to which he has already contributed notably. Mr. Hook has been president and general manager of the American Rolling Mill Company of Middletown, Ohio, since 1931. During the World War he was chairman of the Civilian Relief Committee and vice-chairman of the American Red Cross at Cincinnati. He is a member of the National Industrial Conference Board and of the metallurgical advisory board of the Carnegie Institute of Technology and the United States Bureau of Mines. He is also a member of the National Council of Boy Scouts of America and last year was president

Harris and Ewing

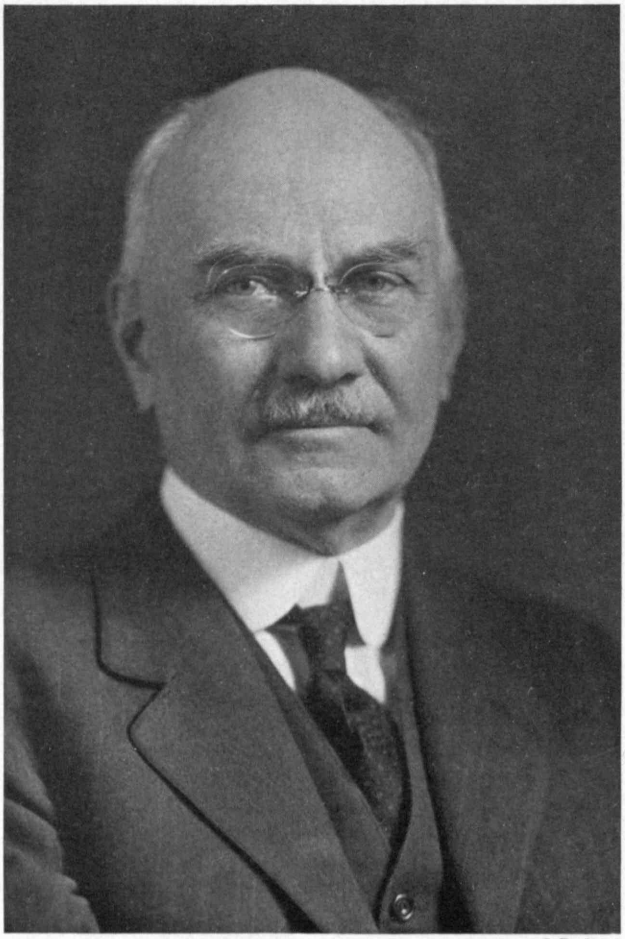
VANNEVAR BUSH, '16

of the National Association of Manufacturers. He has given generously of his time to various civic activities and has been active in numerous industrial projects.

Edison Medal Award

DUGALD C. JACKSON, Professor Emeritus and former Head of the Department of Electrical Engineering at the Institute, has been awarded the 1938 Edison Medal of the American Institute of Electrical Engineers, the highest award in electrical engineering. The award was made to him in recognition of "outstanding and inspiring leadership in engineering education and in the fields of generation and distribution of electric power." The presentation was made on the evening of January 25, during the annual winter convention of the A. I. E. E. in New York.

Professor Jackson was born at Kennett Square, Pa., in 1865 and received the degree of civil engineer from the Pennsylvania State College in 1885. He spent the next two years in graduate study in electrical engineering at Cornell University. His early engineering experience was gained as vice-president and engineer for the



© Bachrach

DUGALD C. JACKSON

Western Engineering Company of Lincoln, Neb., a firm which was engaged in the design and construction of electric light and power plants and distribution systems. He was assistant chief engineer with the Sprague Electric Railway and Motor Company of New York City from 1889 to 1891 and later was chief engineer for the central district of the Edison General Electric Company, supervising in these positions the design and construction of many electric railway and power plants.

In 1891 he formed a consulting engineering firm with his brother, W. B. Jackson, and also became professor of electrical engineering at the University of Wisconsin. The latter post he retained until 1907, when he was appointed professor and head of the Department of Electrical Engineering at the Institute, in which position he notably wove research into the fabric of engineering education. He remained as head of his Department until 1935, when he retired as professor emeritus. He was succeeded by Technology's present Dean of Engineering, Edward L. Moreland, '07, senior partner in the firm of Jackson and Moreland. This Boston consulting engineering firm, organized in 1919, specializes in electric power production and distribution, and in railway electrification.

Professor Jackson joined the American Institute of Electrical Engineers in 1887 and was its president in 1910–1911. He served as lieutenant colonel of engineers in France during the latter part of the World War and was chosen a United States government delegate to the World Engineering Congress at Tokyo in 1929. He was also a member of the National Research Council from 1928 to 1936 and is a member of the board of investigation and coördination of the Society for the Promotion of Engineering Education.

He is a chevalier of the Legion of Honor of France, president of the American Academy of Arts and Sciences, a fellow of the American Society of Mechanical Engineers and the American Physical Society, a member of the American Philosophical Society, the American Society of Civil Engineers, the Institution of Electrical Engineers of London, the Société Française des Electriciens of Paris, and the American Institute of Consulting Engineers, of which he was president in 1938.

Professor Jackson is the author of five books on electrical engineering and many articles on engineering projects and engineering education. Columbia University conferred upon him the honorary degree of doctor of engineering in 1932.

Other Technology men who have been recipients of the Edison Medal in the past are the late Elihu Thomson; William D. Coolidge, '96, Director of the Research Laboratories of the General Electric Company; Frank B. Jewett, '03, President of the Bell Telephone Laboratories; Arthur E. Kennelly, for 11 years a member of the Faculty of the Department of Electrical Engineering; and Willis R. Whitney, '90, Vice-President in Charge of Research of the General Electric Company.

Friendship Among Nations

STRESSING the comparatively recent role of the Western Hemisphere as the refuge of world opinion, the annual report of Dean Carl W. Ackerman of the Graduate School of Journalism of Columbia University — the Pulitzer school — remarks upon the widening of the horizon of the Western world and upon the fact that the New World has become the chief repository of world information. One main agency in the preservation of information and exchange has been the integrity of the press, which must likewise serve to create amity and concord among nations. For reasons implicit in these facts, Dean Ackerman declares it "good fortune" that the second quarter-century of his school's history commences with the announcement of the Maria Moors Cabot Prizes, established by Godfrey Lowell Cabot, '81, as awards to publishers, editors, or writers in the Western Hemisphere, who, by their professional achievements, advance sympathetic understanding among the peoples of South, Central, and North America. Liberal interpretation of public service in journalism is provided in the agreement for the prizes.

"The Cabot awards," Dean Ackerman's report declares, "should make it possible for the press of South and Central America to send a new type of unofficial envoy to the United States, a journalistic ambassador who may make an important and lasting contribution by advancing the information and knowledge of the people of the United States in regard to their Latin-American neighbors." Recipients of the prizes, award of which for 1938 will be announced early this year, will

come to New York to receive them in April and during their visit to this country will have opportunities to meet North American journalists and publishers, and to lecture at Columbia and other educational institutions.

The establishment of these prizes is but another indication of Dr. Cabot's lifelong interest in contributing to the advancement of society. As an active Alumnus of the Institute and a life member of its Corporation, he has given generously to many projects of great importance. Only this academic year he established at the Institute a fund of $647,700 for a far-reaching program of chemical, mechanical, and electrical research on the conversion of solar energy into forms useful for the tasks of man (see The Review, June, page 363). A year ago he made a similar gift to Harvard University for solar energy research in other fields of science.

Dr. Cabot, who has been interested in aeronautics since 1904, contributed substantially to the fund which made it possible for the Institute to build the Wright Brothers Wind Tunnel, at the dedication of which he presided last fall. Long a member of the Aero Club of America, Dr. Cabot was one of its governors for several years and for one year served as vice-president. He has been either governor or president of the National Aeronautic Association since 1922 and he has been vice-president of the International Air Federation continuously since 1926. In 1931, King Carol of Rumania bestowed upon him the decoration of Commander of the Star of Rumania. In addition to serving on the Institute's Corporation, he is a trustee of Norwich University.

Glass, Or Is It?

THE to-do created by parallel invention of something that you can't see continues to stir cartoonists, columnists, commentators, and cranks. Within the Institute, where one of the inventions took place, as already reported to readers of The Review (January, page 127), an exhibition of what purported to be the product recently bestirred our undergraduate contemporary, *The Tech*, to place upon a member of its staff the responsibility of determining the divisibility of invisibility, or the task of fractionation of the hallucination, as reported in the following story:

An attempt to hoodwink Technology students was neatly foiled yesterday through the efforts of several of THE TECH reporters, when an alleged exhibit of 'invisible glass' was exposed as a total fraud.

The Society For The Advancement of Useless Research, prominent faculty activity, it was learned, sponsored the exhibit, consisting of a showcase with an ordinary glass beaker, showing glass before treatment, as explained by a card attached to the top of the beaker, and another card, suspended in midair from behind supposedly resting on the top of the 'invisible glass' beaker.

The application of several qualitative tests to the exhibit showed almost conclusively that no glass was present where the 'invisible glass' beaker should have been. The presence of paradichlorbenzene, organic acids, and traces of 'Gone With The Wind' have not as yet been explained by the analytical laboratories of THE TECH.

The 'invisible glass beaker' was turned over to the Testing Materials Laboratory of THE TECH, where Joseph Blowe, '40.99, recognized authority on invisible glass, subjected it to further tests to prove that the exhibit was a fraud. A sharp blow of the special hammer used to test the tensile strength of invisible glass, and also used to find its Blowe Constant, was given the 'beaker.' Then Blowe bravely thrust his hand into the unseen fragments, where, if he found his hand cut upon extricating it, it would be definitely proved, contrary to analysis, that invisible glass was present. Blowe's hand was unhurt; so it may be safely assumed that no glass was present.

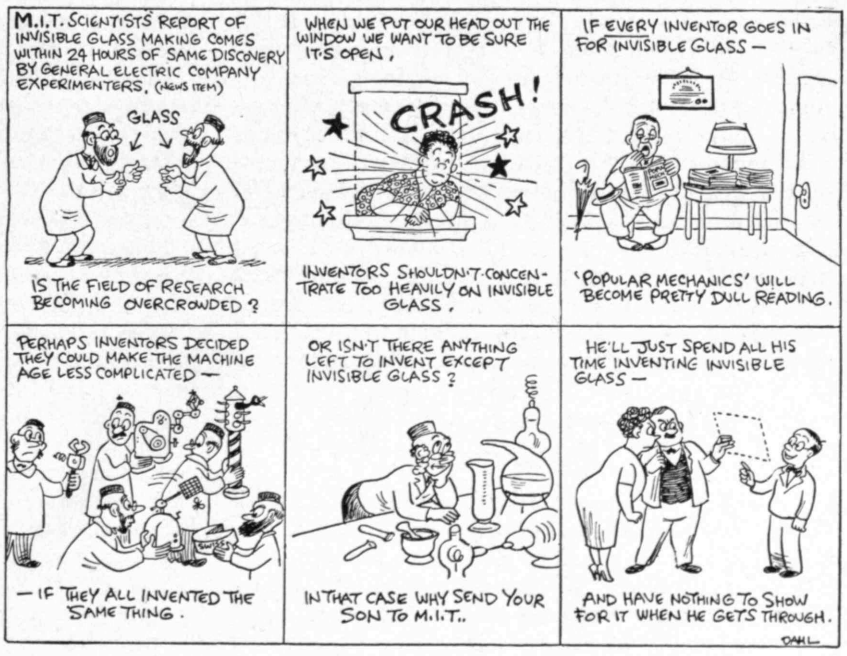
Invisible glass not of this type has been invented simultaneously by a researcher at the General Electric Laboratories in Schenectady, and one here at the Institute.

Rhodes Scholarship Winner

VERNON G. LIPPITT of Westwood, N.J., a fifth-year student in the coöperative course in Electrical Engineering, was awarded one of the four Rhodes scholarships for which students in New England recently competed. Lippitt plans to attend Oxford University next year, where he will concentrate on physiology, a field which suggests interesting electrical applications.

Lippitt is the son of Mr. and Mrs. Walter O. Lippitt. He was graduated from Westwood High School in 1933 and entered M.I.T. in September, 1934, as holder of a freshman competitive scholarship. He has won undergraduate scholarships each year while at the Institute and last year was recipient of a Rogers Award. Lippitt won his numerals in track and as a member of the freshman relay team and was co-captain of the basket-

As Dahl of the Boston Herald *depicts them — a few of the possibilities inherent in duplication of invention. For further commentary on the invisible-glass situation — especially in the Institute — see the story adjacent*



ball team last year. In addition to his athletic activities he has been interested in the Dramashop, the undergraduate theatrical society. He is a member of the committee of the Technology Open Forum, of Tau Beta Pi, and of the honors group of students in his Course. Readers of The Review will recall in last June's issue Lippitt's article, "Should I Trade in My Car?" — a paper first presented in a Stratton Prize Competition.

Other Institute men who have won Rhodes Scholarships in recent years are Morris F. Shaffer, '30, Ivan A. Getting, '33, and Walter H. Stockmayer, '35.

Rogers Awards

THE William Barton Rogers Awards, made annually in memory of the founder of the Institute in recognition of high scholarship, character, and leadership in student affairs, signalize outstanding members of the senior class. The six recipients of this year's awards, which have a value of $300 each, are Frederick B. Grant of Bernardsville, N.J.; Richard S. Leghorn of Winchester, Mass.; Morris E. Nicholson of Cleveland Heights, Ohio; Stuart Paige of Greenwich, Conn.; Walter B. Parker of Cape Elizabeth, Maine; and William F. Wingard of Baltimore, Md. Presentation of the awards was made by President Compton in his office in the presence of the Faculty committee on undergraduate scholarships and the heads of the academic Departments in which the students are studying.

Grant is studying business and engineering administration and entered the Institute from Phillips Academy, Andover, Mass., from which he was graduated in 1935. He is general manager of "Technique" and is the son of Mr. and Mrs. Frederick E. Grant. Leghorn, who is studying physics, is the son of Mr. and Mrs. George M. Leghorn and is a graduate of Winchester High School. He is secretary-treasurer of his class and treasurer of the combined musical clubs. Nicholson, the son of Mrs. Jessie C. Nicholson, is a student of metallurgy and a graduate of Cleveland Heights High School. He is secretary of the Beaver Key and treasurer of Tau Beta Pi, the national honorary engineering society.

Paige, a student of business and engineering administration, is the son of Mr. and Mrs. Clifford E. Paige and was graduated from Brooklyn Polytechnic Preparatory Country Day School. He is president of the M.I.T. Athletic Association. Parker, a student of chemical engineering, is the son of Mr. and Mrs. Walter B. Parker and entered the Institute from Bowdoin College in 1936. He is vice-president of the senior class. Wingard is studying general engineering, having entered the Institute from Gilman Country School in 1935. He is president of his class.

Foreign Student Enrollment

A STUDY of enrollment of foreign students in American educational institutions reveals that among universities and technical institutions with enrollments of 100 or more foreign students, the Institute, with a foreign registration of 8.1 per cent of its total enrollment, stood first last year. This study is based on a report on foreign student enrollment made by the Institute of International Education and a survey of total enrollment published by *School and Society*.

Among educational institutions having 45 or more foreign students, three stood higher than the Institute on the basis of percentage: The College of the Pacific, with 56 foreign students in a total enrollment of 226, had a percentage of 24.8 per cent; the Pacific Union College, with 47 foreign students out of a total of 204, had 23 per cent; the Montana School of Mines, with 31 in a total enrollment of 359, had 8.6 per cent foreign students.

The institutions with 100 or more foreign students are shown in the following table:

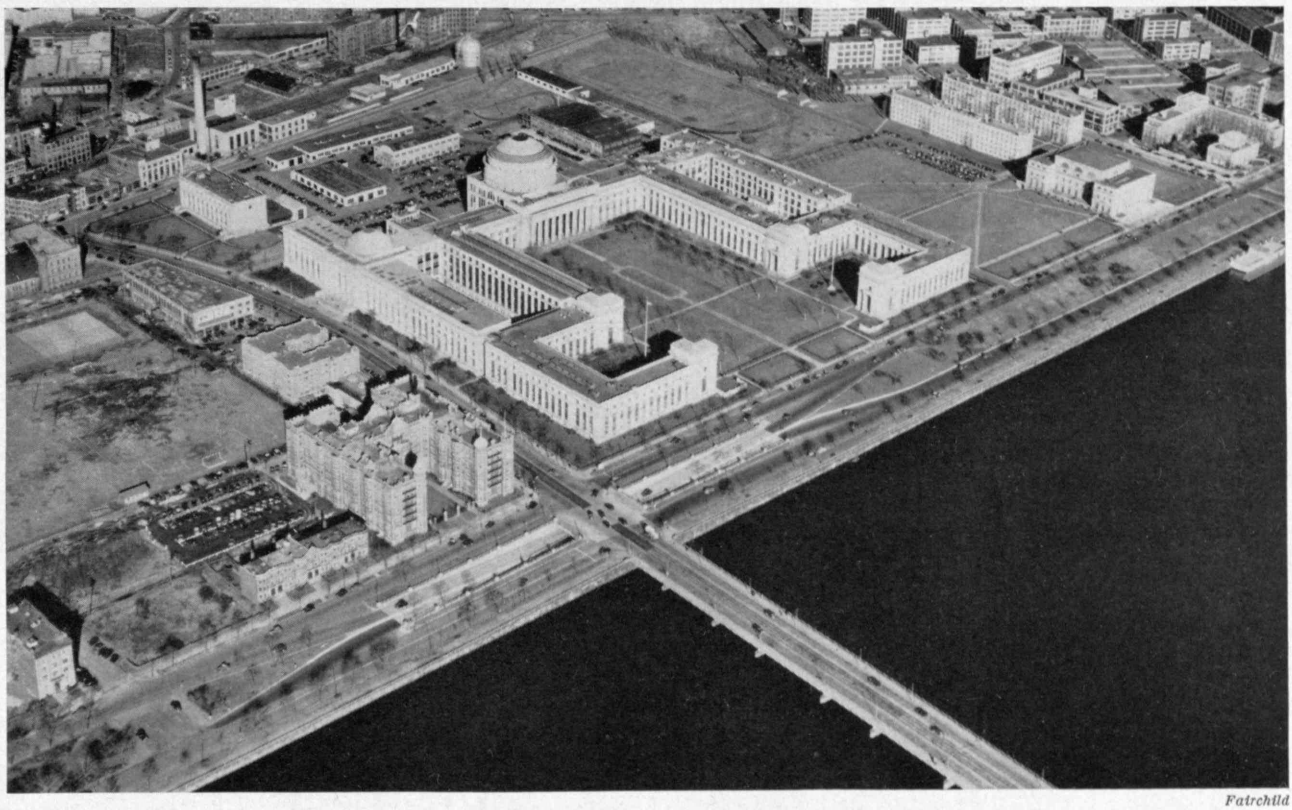
Name of Institution	*Number of Foreign Students*	*Number of Full-time Students*	*Per Cent of Foreign Students*
University of California	1,029	22,955	4.5
University of Southern California	268	4,707	5.7
Yale University	104	5,221	2.0
University of Chicago	128	6,035	2.1
Louisiana State University	124	7,644	1.6
Harvard University	210	8,138	2.6
M.I.T.	239	2,966	8.1
University of Michigan	309	10,952	2.8
University of Minnesota	120	13,691	0.9
Columbia University	372	14,683	2.5
Cornell University	224	6,439	3.5
New York University	203	13,377	1.5
University of Pennsylvania	108	7,015	1.5
University of Washington	499	10,864	4.6

International Yardstick

ARGUING that "science is now the chief positive characteristic of civilisation, and the degree in which it is cultivated provides essential information on a country's cultural, industrial, and military strength," the scientific correspondent of the Manchester *Guardian* recently maintained that the decline in relative power of Great Britain which was illustrated in the Munich negotiations may also be measured by the yardstick of effort and treasure expended on scientific investigation.

According to figures from the Parliamentary science committee, the *Guardian's* correspondent pointed out, the total expenditure on scientific research, including that done by individuals, amounts to about four million pounds in Great Britain. This is less than one-tenth of one per cent of the national income. The estimate for the United States is about fifty million pounds, or about one-half of one per cent of the national income; for the Soviet Union, a billion rubles, or about one per cent of the national income. Even after corrections for variations in the definition of research, the conclusion is reached that the expenditure in England is far less than that in the United States.

To emphasize his point, the *Guardian's* correspondent concludes with the following remarks of particular interest to readers of The Review: "The disparity of resources between British and American academic institutions is rapidly growing. For instance, the Massachusetts Institute of Technology has thirteen professors, seven associate professors, and eleven assistant professors of chemistry. There are seven professors of physics,



Fairchild

Technology's continuing growth is clear in this first aerial photograph since the completion of the new Rogers Building, whose dome appears to the left of the central dome. The former Riverbank Court Hotel, now the Graduate House, is in the left foreground. A line drawn from the front left corner of the Graduate House to bisect the Rogers dome will terminate in a low building in the left background, on Vassar Street. This is to house the cyclotron being constructed on grants from the John and Mary Markle Foundation. To the right of the cyclotron's abode, and separated from it by a laboratory building, looms the steel shell domicile of the Van de Graaff generator. The Wright Brothers Wind Tunnel is to be seen at the rear of the Guggenheim Building

twelve associate professors, and six assistant professors.* The associate and assistant professors are not obscure persons. They include Van de Graaff, M. S. Vallarta, and F. W. Sears, respectively famous for their work on high-tension machinery, cosmic rays, and high-frequency sound waves. There are eleven professors of electrical engineering, supported by eleven associate professors and six assistant professors. These large staffs receive a correspondingly large space and resource for research, and as there are so many investigators a wide range of problems is studied. The M.I.T. has an endowment of £10,000,000, of which £4,000,000 was provided by George Eastman, the inventor of the Kodak. Several American scientific institutions have received endowments of comparable size. They will soon overtake British research laboratories, where they have not done so already, unless a far bolder and more generous policy towards research is adopted here."

Coast to Coast

THE important research in the medical, geological, and chemical applications of artificially radioactive substances now being carried on in the Department of Physics at the Institute, under the direction of Robley D. Evans, was the subject of a nationwide broadcast on the program of the American School of the Air of the Columbia Broadcasting System on the afternoon of January 11. The chief speakers on this program were President Compton, Dr. Evans, and J. Rhyne Killian, Jr., '26, recently appointed executive assistant to President Compton.

The broadcast was made directly from Professor Evans' laboratory. One of the many values of this advance in science is its application in medicine. Dr. Evans and his research staff, with the coöperation of medical scientists in near-by institutions, are investigating the artificial production of radioactive chemicals and their possible medical use.

Dr. Evans spoke specifically on artificially radioactive iodine, a chemical which finds its way directly to the thyroid gland. While it is not yet applicable to the treatment of disease in human beings, its development encourages hope for, eventually, a new method of attack on the most stubborn diseases. Although the detection of radioactivity is a complicated scientific technique, its effects, Dr. Evans said in his broadcast, can be detected by anyone who has a watch with luminous figures on its dial. It is necessary only to go into a dark closet and look at the figures through a magnifying glass of a power, say, of 20 or 30 diameters to see the numberless individual flashes caused by exploding atoms in the radioactive paint on the figures.

* The *Guardian's* correspondent, according to the current Institute Catalogue, is slightly in error statistically; his intentions, however, may be said to remain uninjured by this fact.

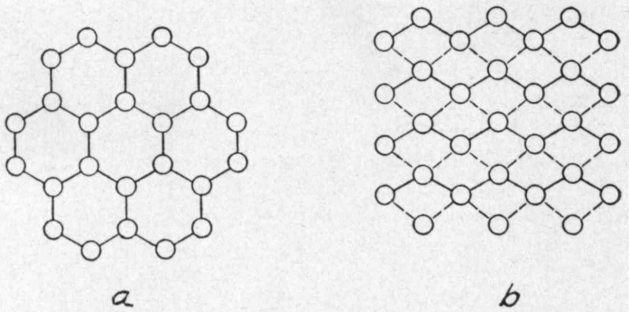
During the broadcast, which was heard in thousands of high-school rooms and by a general audience of several million listeners, Dr. Compton spoke of the potential accomplishments of coöperative research between groups in various fields of science. Mr. Killian discussed important research projects now in process in various other Departments of the Institute. Clark Goodman, one of Dr. Evans' assistants, spoke on some very interesting geological studies by which the age of the earth is determined by examination of radioactive substances.

"Broken Down Ice"

WATER, the most important and most common of all liquids, is nevertheless one of the strangest and least understood. To dispose of it glibly by saying "H_2O" does not settle the matter, even though that may sound quite authoritative. This condition of sketchiness applies to our entire knowledge of the structure of liquids. For the gaseous and the crystalline states of matter, reasonably satisfactory theories of structure have been determined, but for the liquid, we have little or no competent knowledge. We know, for instance, that water is unlike most materials in that it expands on freezing and that the solid form — ice — floats on the liquid. To answer the question of why or how this phenomenon is dependent upon the structure of the water molecule is part of the business of a theory of structure. The practical importance of the phenomenon is obvious to him who speculates on what life would be like if ice sank.

The investigator who wants to find out how water molecules are put together in water or ice has recourse to the x-ray as a sleuth. Much as the familiar glass prism breaks common daylight into splashes of colored light on the wall, molecules break x-rays into diffraction patterns. By the study of these patterns an idea of the arrangement of molecules in matter may be secured. During the past four years a comprehensive program of x-ray diffraction study of the structure of amorphous — that is, noncrystalline — matter has been under way at Technology. The two most important examples of amorphous matter — glass and water — have been the principal subjects of the study. Unlike crystalline substances, which give sharp x-ray diffraction patterns, amorphous materials produce patterns consisting of broad, diffuse halos. From a Fourier analysis of the latter, however, may be directly obtained the distribution of neighboring atoms or molecules about any one molecule in the sample.

Results of a recent x-ray study of water, undertaken by Professor B. E. Warren, '24, and J. Morgan of the Department of Physics, show that the molecule does not act like a spherical, but rather like a tetrahedral, molecule. This tetrahedral formation is strikingly shown in the crystalline structure of ice, in which each molecule has four neighbors in the directions of the four corners of a tetrahedron, presumably with the positively charged corner of one pointing toward the negatively charged corner of another. These forces of electrostatic attraction hold the ice crystal together. In water, the study indicates, the number of neighboring molecules is approximately four, and thus the water structure is similar to that of ice. But in water, neighboring molecules are found also at intermediate distances. Both water and ice are structures of abnormally open type, differing in this regard from materials having spherical molecules, which are usually more closely packed since 12 spheres can be grouped about any one sphere. When the ice melts, this open structure of the crystal is altered as molecules appear at intermediate spaces, so that the open structure of the ice is somewhat filled in by the melting. This partial filling is the reason why the density of the liquid water is higher than that of the crystalline ice.

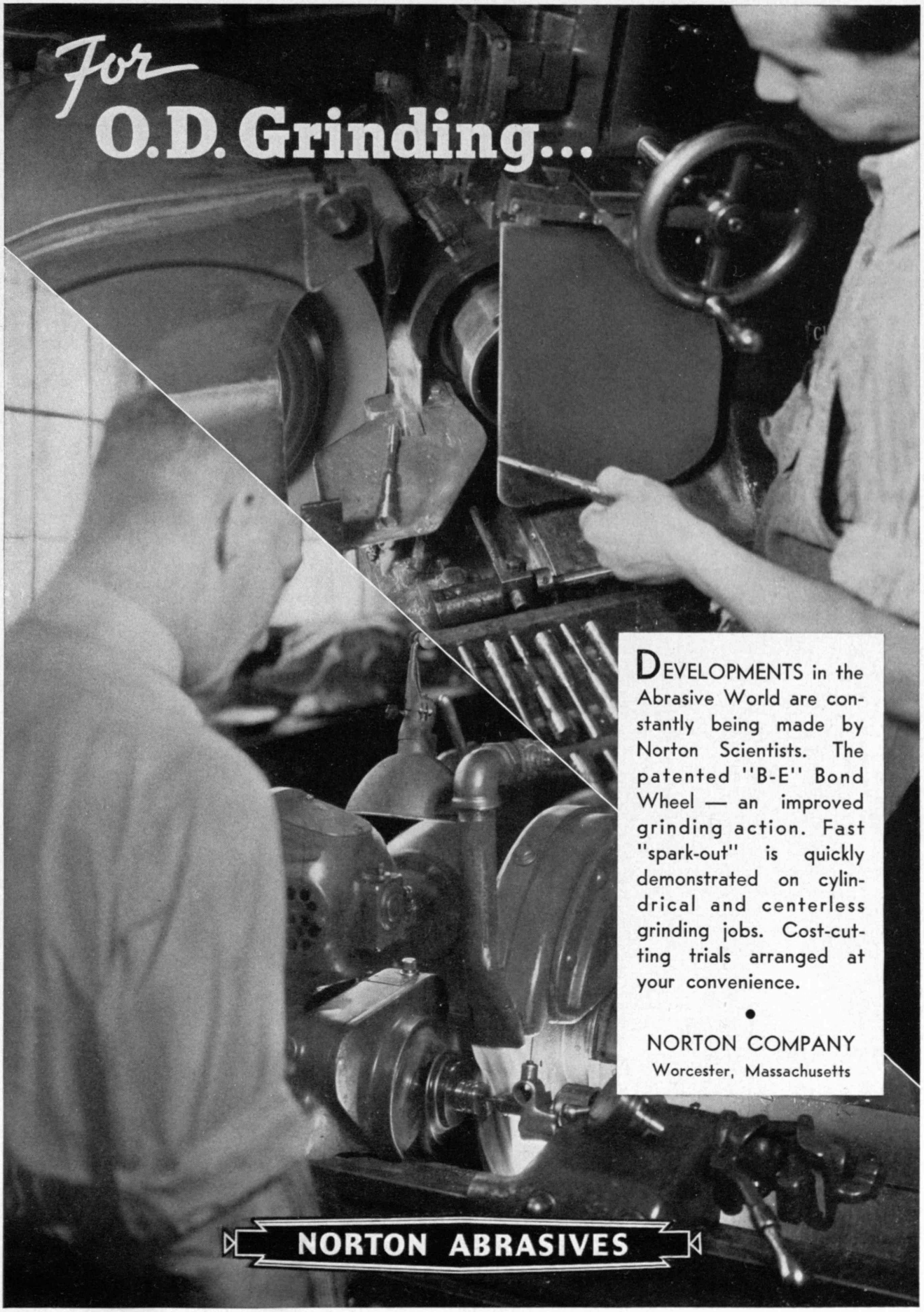


The paradox of increase in intermolecular distance which does not decrease density is illustrated in these two diagrams. In a *are depicted a number of molecules each of which is bonded to three neighbors at a definite distance. In* b *each molecule has two nearest neighbors at the same distance as in* a, *and two next nearest neighbors at a distance 10 per cent greater. The average intermolecular distance is therefore greater in* b. *Yet because of the closer scheme of packing, the density of* b *is 27 per cent larger than that of* a

The shortest distance from one molecule to another in ice is 2.76 angstroms (an angstrom unit is one hundred-millionth of a centimeter). In water at one degree C. the distance is found to be 2.90A, and the distance increases to about 3.05A at 80 degrees C. Thus in the change from ice to water the intermolecular distance actually increases, so that one might expect the density of the material to decline. The potential decrease in density is more than offset, however, by the increase in density caused by the filling in of the open ice structure.

Thus as the temperature of water is raised, two opposing effects occur: the breaking down of the tetrahedral structure and the consequent filling in of the open space, which tends to increase the density; and, at the same time, the increase of intermolecular distance with the rise in temperature, which tends to decrease the density. The minimum volume of water at four degrees C. is the result of these two opposing effects.

The essentially tetrahedral nature of the water structure is shown by the x-ray results but cannot be described in terms of a definite number of neighboring molecules at certain definite distances. A degree of indefiniteness is inherent in the nature of the liquid state. The phrase "broken down ice structure" is an apt description of water if it is taken as meaning a structure in which each water molecule is striving to bond itself tetrahedrally to four neighboring molecules — as in ice — but in which bonds are continually breaking and reforming so that at any instant a molecule will be bonded to less than four neighboring molecules and will have other neighbors at a variety of distances.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Rotch Library

THE admirable library of the School of Architecture is to be called the Arthur Rotch Library of Architecture, in honor of the memory of one of the School's early students, a member of the Corporation from 1885 to 1894, and a benefactor whose many contributions greatly assisted the School in the lean years of the Institute's history.

After being graduated from Harvard University in 1871, Arthur Rotch studied architecture at the Institute, where he was a member of the Class of 1875. His great interest in the School was manifested in many ways during a distinguished architectural career. Upon his death in 1894 he bequeathed to the Institute the sum of $40,000. Of this amount, $5,000 was for a fund the income of which was to be used annually for the benefit of the library of the School; $5,000 was to establish a fund the income of which was to be used for an annual prize for the student who was graduated highest in his class; and a third sum of $5,000 was to provide income for an annual prize for the student who ranked highest at the end of a two-year special course in architecture. Mr. Rotch asked that the remaining $25,000 be devoted to the general purposes of the School. In addition to this bequest he also left to the School his library of art and architecture.

With his brothers and three sisters, Mr. Rotch in 1883 founded the Rotch Traveling Scholarship for study and travel abroad. He was a member of the firm of Rotch and Tilden which constructed many public and private buildings in Boston and other parts of the country, among them the art museum and art school at Wellesley College and various churches and libraries in New England. His firm was the first to revive the Colonial style for modern buildings, a trend that spread rapidly throughout the country. Mr. Rotch is also said to have been the first to advocate the use of roughcast as a finish for buildings. Among the notable buildings of which he was supervising architect was the old Suffolk County Courthouse in Boston, and he later designed the Devonshire Building, one of the best known of the city's office buildings in its day.

During his studies abroad he was a regular correspondent for architectural magazines and occasionally wrote articles for daily newspapers, notably the London *Daily News*, for which he described the situation in Turkey and Bulgaria after the Russian invasion.

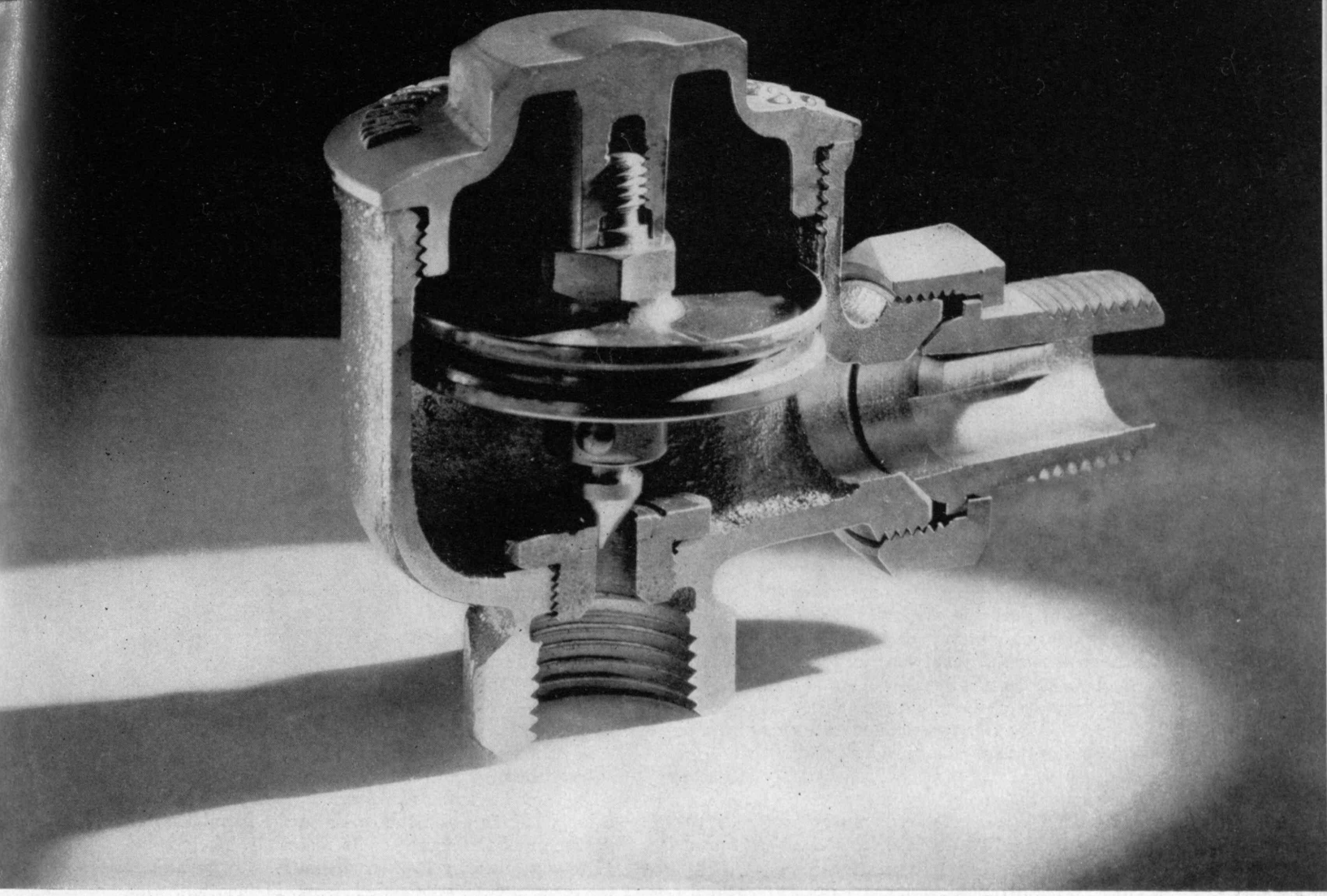
Holding the Heat

IN AN institution such as Technology, extremes and opposites are commonplaces. Physicists break the atom into bits; chemists meanwhile build up molecules

Stone and Webster

CAPITALS

. . . of columns in the rotunda of the new Rogers Building, in close-up view from the upper gallery



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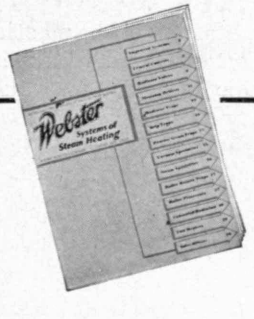

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into more and more complex patterns. Biologists nurse bacteria to lush growth in culture media, while biophysicists are slaughtering other bacteria by the billion in a stream of lethal radiation. It is therefore not surprising that while chemical engineers are laboring to speed up the rate at which heat is transferred from one body to another, heat engineers should be taxing their ingenuity to keep heat from being transferred. In this work the Institute's heat engineers are now better equipped than ever before, with the housing of their laboratory in the basement of the new Rogers Building. The new quarters not only have improved light and space but also are far more efficient in mechanical conveniences and apparatus.

Independent valving and switching systems, installation of which was made possible by the fact that the laboratory was part of a new building, serve to make it a self-contained unit whose work need not be interfered with by local slackening of gas or water pressure or by diminution of available electricity. Pressure regulators on gas, water, and air lines are important in this regard. Constant-temperature and low-temperature rooms are available to test actual house-wall sections under winter conditions more effectively than in the old quarters. Temperatures in other types of apparatus may be maintained constant to within one one-hundredth of a degree. In general, the range of the thermal-conductivity equipment of the laboratory is among the best, if not the best, anywhere available. Temperatures from 3,000 degrees to minus 110 degrees F. can readily be produced in the laboratory.

The two main functions of the laboratory, which is under the direction of Professor Gordon B. Wilkes, '11, of the Department of Mechanical Engineering, are the instruction of students in the methods and difficulties of the measurement of temperature and the prosecution of research into the general problems of heat transfer. In the process of setting up the laboratory, still under way, the research function has thus far taken second place to making the facilities available for teaching.

As the research sections of the laboratory are made ready, studies of insulating materials and research into other problems of heat transfer will get under way. In this work the location of the new laboratory within easy reach of the laboratories of air conditioning and of refrigeration is expected to be very useful.

Modular Service

WORD comes of the recent formation of the Modular Service Association, a nonprofit corporation established by the heirs of the late Albert Farwell Bemis, '93, to carry on that part of his research and development work in housing which dealt with simplification, coördination, and efficiency in the building industry through the correlation of dimensions. The Modular Service Association is not to be confused with the Albert Farwell Bemis Foundation which is an endowed department of the Institute and, as readers of The Review know, is intended to engage in research and the dissemination of information of value to the building industry. (See The Review, July, page 410.)

The new association is an independent organization and will enter a program of broad coöperation with the American Standards Association under a new project, "Co-ordination of Dimensions of Building Materials and Equipment," which has been undertaken under the joint sponsorship of the American Institute of Architects and the Producers' Council; it will add to this program the task of direct coöperative service with individual manufacturers, builders, and architects in the development of suitable modular details and standards.

Thus an important contribution made by Mr. Bemis — one outlined by him in Volume III of his standard work, "The Evolving House" — is to be given further opportunity for development. Alan C. Bemis, '30, is chairman of the executive board of the new organization.

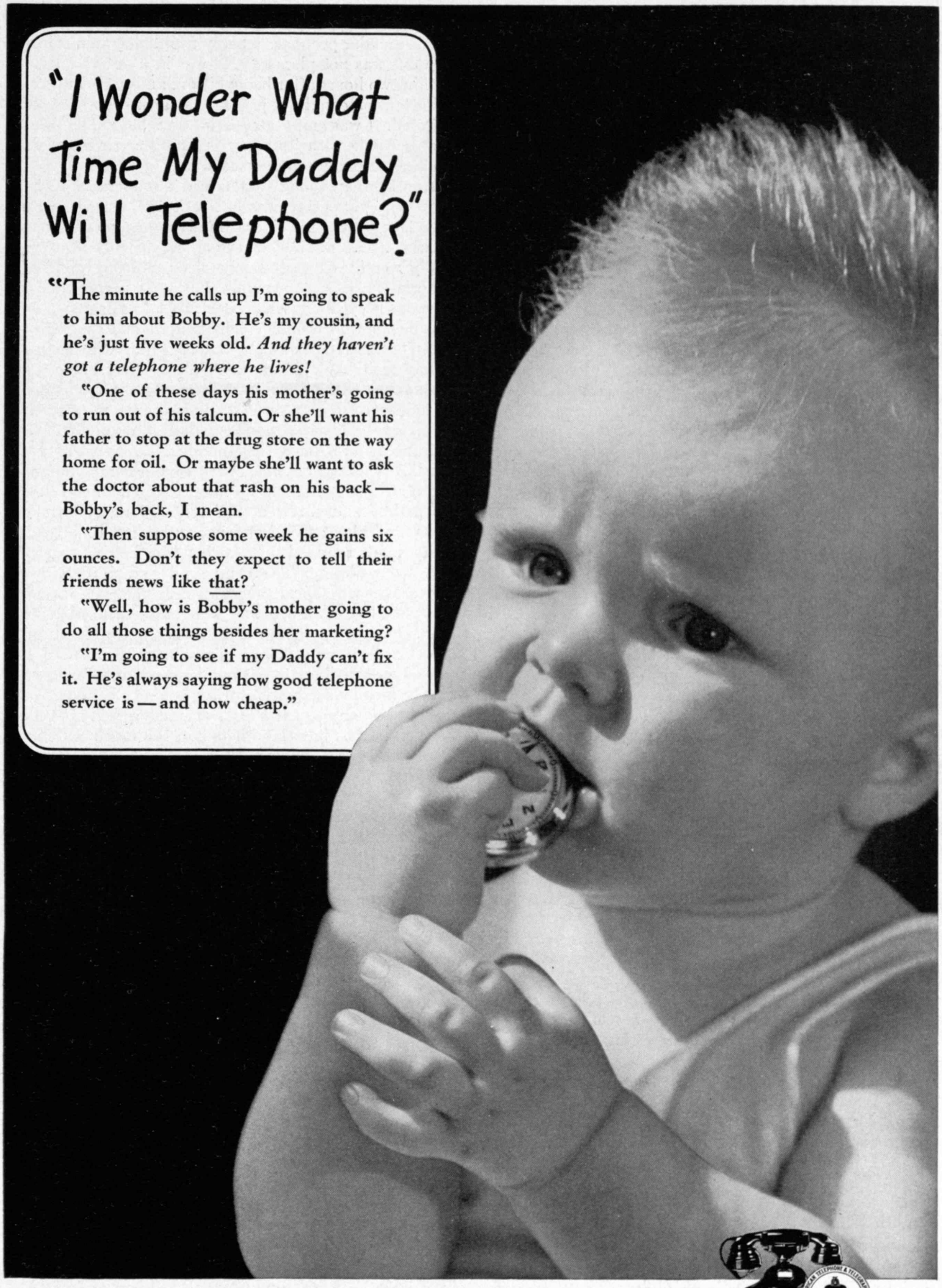
On the Air

FOUR international radio broadcasts on "Better Homes for Better Living" were presented by the Institute through the World Wide Broadcasting Foundation last month. In this series four members of the Faculty coöperated in discussing the development of the home — its foundation, design, construction, and use.

"Mother Earth: the Foundation and Source of Supply" was the subject of the first lecture, which was given by Professor Frederick K. Morris of the Department of Geology. He discussed the earth as the foundation of the home and the source of its materials. The second lecture was given by Professor John E. Burchard, '23, Director of the Albert Farwell Bemis Foundation, who spoke from the point of view of the architect, tracing the history of shelter and its development in the advancement of society. His talk was titled, "Man's Conception of the Home."

"The Home Interpreted," the third lecture of the series, was by Professor Walter C. Voss, '32, Head of the Course in Building Engineering and Construction, and described the various materials used in modern construction, including metals, wood, glass, plastics, concrete, and brick. He considered these materials in two classifications: those which are irreplaceable and those which are replaced by nature. Murray P. Horwood, '16, Professor of Bacteriology and Municipal Sanitation in the Department of Biology and Public Health, delivered the final lecture, "The Comfort and Ease of Living in the Home." Dr. Horwood, who is widely known for his studies in public health, spoke of the modern aids to healthful living, including heating, air conditioning, and various other services that contribute already and may contribute further to convenience and the advancement of comfort.

These broadcasts were part of an educational program in which the Institute participates from time to time, notably in reporting the latest advancements in science, a series prepared and delivered by the Editors of The Review on the first Monday of the month during the winter, at 7:30 P.M., Eastern Standard Time. Those who have short-wave radio receivers may hear this and many other interesting programs from the World Wide Broadcasting Foundation's Station W1XAL, by tuning to 6.04 megacycles (49.6 meters).



"I Wonder What Time My Daddy Will Telephone?"

"The minute he calls up I'm going to speak to him about Bobby. He's my cousin, and he's just five weeks old. *And they haven't got a telephone where he lives!*

"One of these days his mother's going to run out of his talcum. Or she'll want his father to stop at the drug store on the way home for oil. Or maybe she'll want to ask the doctor about that rash on his back — Bobby's back, I mean.

"Then suppose some week he gains six ounces. Don't they expect to tell their friends news like that?

"Well, how is Bobby's mother going to do all those things besides her marketing?

"I'm going to see if my Daddy can't fix it. He's always saying how good telephone service is — and how cheap."

BELL TELEPHONE SYSTEM

You are cordially invited to visit the Bell System exhibit at the Golden Gate International Exposition, San Francisco

THE AIR AND THE JUNGLE

(*Continued from page 165*)

of a jungle river at the edge of this section. Two flights only, each of about two hours' photography, sufficed to cover this 2,000 square miles. Unusual and freakish weather was responsible for this good break, and in 10 days after our arrival at No. 1 photographic base, we finished with it and flew out, abandoning, incidentally, a large stock of gasoline and food stores to the local bushmen.

No. 2 photographic camp was then established. This also was on the bank of a jungle river but was quite near the foothill source of the river some 300 miles from the coast. It had the advantage of being actually in the second area but the disadvantage of requiring the plane to be moored in a somewhat unsafe place, as the river here was subject to quick and violent floods. These floods nearly lost us the ship on two occasions, so that it was decided to move the base to Murray Lake, a large, swampy, and shallow sheet of water some 30 miles away. Here we were not quite on the area but more than near enough to it to offset the possibility of danger in the river.

At this lake, where continuous rainy weather held us for five solid months, we had experiences with cannibal peoples, with crocodiles, with pythons, with heavy enervating fevers, with native attacks, with the dankest kind of living in continual hot rain under three superimposed, ineffectual tent flies. These things, augmented by our own carriers' being down with dysentery, by petty alternate skirmishing and trading with neighboring head-hunters, by snakes biting our three most useful native armed police, are the things which stay in memory and which spiced the work itself.

For instance, on a morning of unusually hard rain, yells and shrieks rising from the negative sound of drenched jungle to the high pitch of a person in agony, brought the four whites of our party out of their tents on the run. Three hundred yards from our compound we had built a small rough pier of bamboo; it served the dual purpose of landing jetty for the airplane dinghy and of washing stage for our laundry boy. The latter, at work and kneeling over the edge toward the five feet of muddy lake water, had been seized on his right arm by a crocodile. The croc must have been waiting for him under the jetty. We arrived quickly, but there before us were the rest of the camp carriers, all frenziedly busy cutting bamboo poles with their machetes and then hurriedly poking them into the lake bottom. The water was so agitated and flailed that nothing could be seen in it, and there was so much yelling that very little could be heard, when one carrier waded in from the grassy shore. When he had reached a depth up to his waist, he leaned forward, grasped the unconscious laundry boy, and pulled him ashore. Other carriers continued to poke the lake bottom and yell, while we, after a very quick examination of the injured native, decided that he must be flown out at once to a doctor and hospital.

With the boy screaming and sobbing, with his arm completely shredded from elbow to shoulder and bleeding heavily, we flew out through the rain to the coast. The boy was treated with an improvised tourniquet during the flight, and his fear and terror caused him to exude an odor peculiar to badly frightened animals; the trip out was not pleasant. He was in a native hospital within two hours after being bitten, and yet good medical attention could not prevent the arm from becoming infected. It was amputated a few days later. The bite of the crocodile with its many crushing teeth invariably produces a badly septic condition.

Another happening that added considerable fuel to the entire adventure was an ineffectual but desperate attack upon our first river camp by a group of nomadic warriors. The method of attack was highly strategic, really worthy of a good general or, possibly more appropriately, of a good admiral. It was perpetrated at first dawn when the least bit of light from a rising sun was opening up visibility. The fighters had spotted our camp of three tents and one thatched native house upon the cleared bank of the fast flowing river. They had then taken their entire force, some hundred-odd men, in four large dugout canoes a mile upstream from this camp and had waited, awake and alert, all night. A few minutes before dawn they paddled downstream very hard. As the four dugouts swept by our compound at a speed of about ten miles an hour, every man laid down his paddle and threw at our tents as many bamboo spears, all about five feet long, as he had time to do. The armada rounded the next bend in the river, and all resumed paddling. The compound had a pincushion appearance with spears everywhere, some even through the tents, but not a person of our complement of 22 was hurt. Our first knowledge of the attack was of shouts and the curious ripping noise of canvas, as bamboo spears came through the tent flies and we ran out to see the four tremendous dugouts swirling behind a bend and out of sight. A complaint to the government quickly brought native soldiers, but the others had too much start and were not found. The military tactics here were very obviously to fight as soon as there was barely enough light for aiming and before a freshly awakened enemy could see anything at all.

The weather at this base, roughly in the lowland center of the island, was as discouraging for vertical photography as can be imagined. Day after day a take-off would be made under promising conditions, and when the plane was some 20 minutes out and nearly up to working altitude, a cumulus cloud condition would start forming below us. This, of course, precluded the possibility of any pictures. We would turn and return to our base, and sometimes the cumulus would form so fast that it would be necessary to come in through heavy rain and cloud layers only an hour after the former cloudless condition. The take-offs were always planned for a time that would permit the first exposure to be made as soon as the sun was 25 degrees above the horizon. This limiting time for the start of photography was laid down by experience in similar jungle regions — it amounted to just about two hours after sunrise. As sunrise and also sunset near the equator occur always close to six o'clock, the rule resolved into an eight o'clock starting limit and a four o'clock finishing limit. These times are for the first and the last pictures, although never did we find working weather during the entire afternoon. With the first picture (*Concluded on page 184*)

THE AIR AND THE JUNGLE

(*Concluded from page 182*)

to be taken at eight, a take-off was always made just before seven-thirty, as it was found that just 35 minutes were required from take-off time to altitude in order to orient properly and to establish wind-drift corrections. This scheme in turn meant that the entire camp turned out every morning at about six-thirty.

When photography can be done, with the necessary, rare cloudless condition, the ground can be covered at the rate of about 600 square miles an hour with the type of equipment we used. It is highly essential, therefore, to be always ready in every single way — camera loaded, ship fueled, and otherwise instantly flyable — and then to wait month after month for the break. The weather did come eventually, however, and three flights over an eight-day period finished this second section. The remaining third section, between the two now finished pieces, was abandoned in favor of more photography in an entirely different district, in view of results obtained by test drilling in that district. The camp was, therefore, abandoned. The third base, from which operations were carried on for some two months, was at the town of Port Moresby on the southeast coast, where better facilities and absence of rain sped the rest of the work.

A word concerning climate and health is not out of place. The country seems to be free of typhus, cholera, and yellow fever, but malaria and dysentery are rampant. The dysentery is of a type not so deadly as found in the equatorial African lowlands, but the malaria is extremely common and severe. Fully 95 per cent of our field personnel were down with it intermittently and in some cases continually. A peculiar variant of the disease, known as blackwater fever, which appeared now and then, took the life of one young geologist, and seriously affected others.

As in all exploratory shows, the tinned-food question and lack of refrigeration were important problems. With the air-survey unit the refrigeration problem was very acute, for mapping film has a keeping quality more or less inversely proportional to the temperature and humidity, and continual attempts to photograph, taking the film to high and cold (about 40 degrees F.) altitude always results in a considerable condensation of water on the film when it is returned to the warm ground level. This is a seemingly inescapable problem, as the camera must be continually loaded and ready, and photographing attempts must be made at every time there is the slightest suspicion of a clearing condition.

An accurate stereoscopic interpretation of overlapping air pictures sometimes shows many things of outstanding interest to oil geologists. The characteristic shape and vegetation of salt domes and of other structures of various types, the relative ages of rivers and ridges, which are indicative of folding and priority, are among the many things which sometimes yield strong clues as to best drilling locations. The seeming paradox of air pictures from three miles up helping to detect oil sometimes nearly that far down is literally a matter of seeing the forest in spite of the trees — of seeing faults, anticlines, regions of dead forest, areas of drastically different vegetation, and other obvious things which point the way to a different type of subterranean geology.

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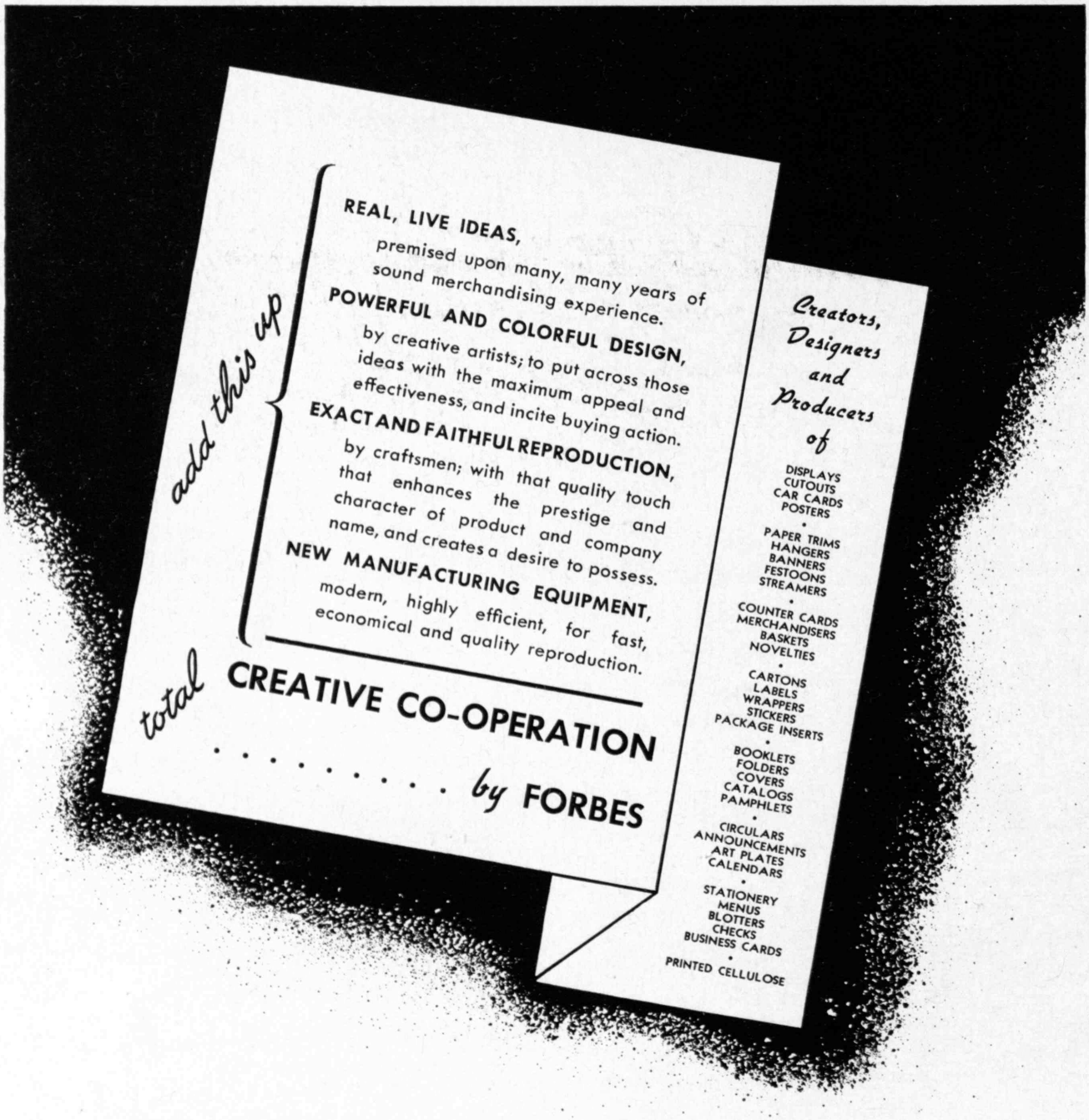

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THE TREND OF AFFAIRS

(*Continued from page 162*)

at all definitive, less than .01 per cent of carbon is permissible in the liquid metal. To produce steel of this sort, a special technique of manufacture has been devised in the Institute's laboratories, by which the materials are melted in the vacuum furnace depicted on page 162. As the materials are liquefied, such carbon monoxide as forms is pumped out, so that a product having a carbon content of less than .005 per cent may easily be made. The vacuum furnace developed during the past year consists essentially of a standard high-frequency induction furnace of 150-pound capacity, surrounded by a specially designed vacuum chamber. The raw material, which is commercially pure iron containing about .015 per cent carbon, is melted in a crucible of pure magnesia in a vacuum of about one millimeter of mercury pressure. After gas evolution has ceased, the furnace is filled with nitrogen gas, the slag materials are added, and the reactions are carried out in an atmosphere of nitrogen.

In addition to laboratory work of this sort, the cooperation of metallurgists, open-hearth superintendents, and others in the industry is being drawn upon. Statistical study of plant data supplied by them, utilizing the Institute's card-punching and sorting equipment, will consider the relationships of slag composition — or iron oxide in the liquid metal — and of carbon in the liquid metal. The data on a good number of heats are already in hand, and it is expected that some five or six hundred heats will ultimately be analyzed.

This coöperative aspect of the study finds its counterpart in the previous scientific training of the group working under Professor Chipman's direction: Karl L. Fetters of Carnegie Tech, Donald L. Guernsey of Illinois, and Shadburn Marshall of Georgia Tech, research assistants; with John C. Vaughan, Jr., of Purdue and Robert A. Steel of Harvard, graduate students.

Toward the Ultimate Automatic

OBSERVERS of the automotive scene tend to agree that an automatic transmission — or, if you prefer, the elimination of the gearshift lever — is a development that must eventually be forthcoming. The constant demand that cars be made easier and easier to drive will, they argue, ultimately result in the incorporation of some sort of automatic transmission into standard designs. A straw pointing the way the wind is blowing may be seen, it is held, in the moving of the gearshift lever from the center of the floor to a position under the steering wheel in current models. Here the urge for greater roominess, to make the front seat accommodate three people comfortably, is the way in which the demand for ease in driving finds expression. As a result, the change in position of the lever increases ease insofar as crowding of people is eliminated but decreases ease because of the somewhat unnatural and strained motion necessary to move the lever. And as a result of this unnaturalness, (*Continued on page 186*)

THE TREND OF AFFAIRS

(*Continued from page 185*)

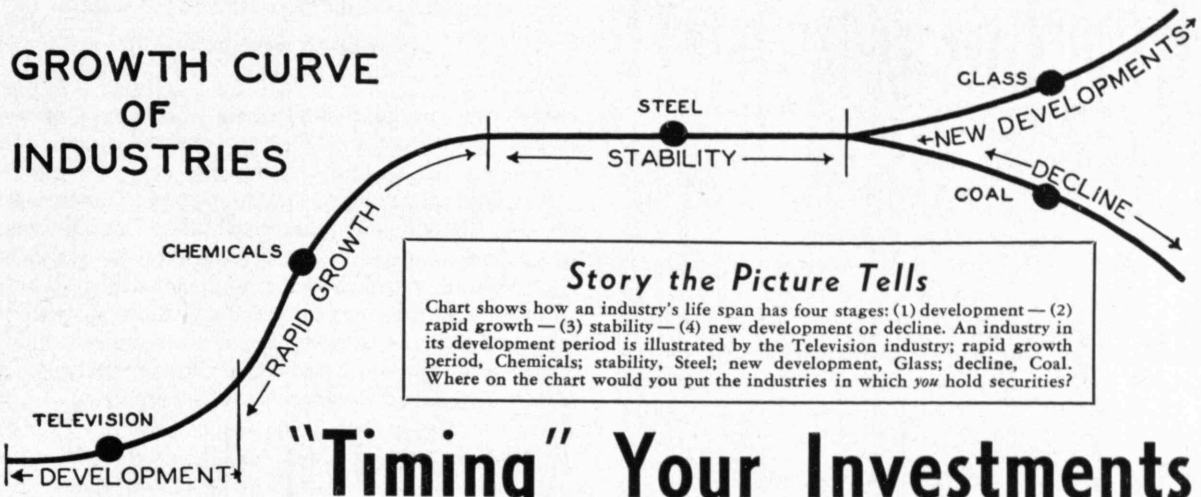
many drivers cut out the second shift, going direct from first to high speed.

Recent announcement of the introduction into American motoring of the "fluid drive" which, as the "fluid flywheel," has been familiar to Englishmen for some years, may be regarded as a more significant straw, even though fewer drivers are likely to become familiar with it directly. In England, where tax rates cut down engine sizes and make economy in fuel consumption highly desirable, the fluid flywheel has been utilized widely in connection with planetary transmissions having four forward speeds. By this means, shifting which is necessary to get a heavily loaded and lightly powered car over grades is simplified.

In its American version, fluid drive is to be seen this year in one maker's custom model. It consists essentially of a hydraulic coupling housed in the hollow flywheel of the motor. One of the two revolving elements spins with the crankshaft of the motor; power is transmitted from it to the other revolving member by motion of mineral oil in which both members are immersed. The oil is set in motion by blades mounted on the driver, as the first member is called. The motion thus generated is imparted to the second member, or runner, through similar blades mounted on it. The runner in turn sends the power on to the drive wheels. There is no mechanical connection between the driver and the runner, and consequently none between the engine and the rear wheels.

The driver turns faster than the runner when the engine is driving the car; in ordinary driving at normal speeds over level roads, the slip, or difference between the rotary speeds of the two, is said to be only about one per cent. When the car is left in gear while the engine is running but the car is not in motion, the slip is virtually 100 per cent, so that very slight pressure on the foot brake will hold a car at the curb even though the engine is running and the gears are set for high speed. Reference to gears here means that between the fluid drive and the differential a conventional transmission and overdrive are mounted, serving to transmit the power which has been sent through the fluid drive.

Though the gears are present, gearshifting as the average driver knows it is well-nigh absent from the driving of cars thus equipped. The car may be placed in high gear and kept there, with no declutching or shifting in the midst of traffic, slowing down to two or three miles an hour with no kicking or bucking. Considerable saving of time through the elimination of manipulation of the shift lever was one of the results in demonstrations of the new device. Acceleration from stop-light halts was found to equal that of gearshift cars in reaching 30 miles an hour and was better than that of the gearshift cars in being a continuous process like that of an electric train, with none of the separate surges of power as between gear speed ranges in conventional cars. This particular characteristic is basis for the claim that the new drive will give a gasoline (*Continued on page 188*)



Story the Picture Tells

Chart shows how an industry's life span has four stages: (1) development — (2) rapid growth — (3) stability — (4) new development or decline. An industry in its development period is illustrated by the Television industry; rapid growth period, Chemicals; stability, Steel; new development, Glass; decline, Coal. Where on the chart would you put the industries in which *you* hold securities?

"Timing" Your Investments

Correct timing in investing means more than buying stocks when they are low and selling them when they are high. Successful investment timing must consider a third phase: "life-time." This is pictured in the chart above.

Just as business as a whole has its periods of prosperity, stability and decline, so too the individual industry must pass through the stages of childhood, maturity and old age.

Your Vital Question

The important question for an investor to ask is: How old is the industry and in what period of its own industrial life is it? These divisions of an industry's life span are roughly four: (1) development; (2) rapid growth; (3) stability; and (4) new development or decline.

Auto — a Good Example

As an example of what a new industry faces in the development period, consider the automobile. For twenty years, from 1890 to 1910, this industry went through innumerable hardships and growing pains. It lacked popular acceptance, output was low, costs high, and mortalities among all companies heavy.

Boom Period

Then in 1910 the industry began to emerge from its formative period into a new cycle in which mass production supplanted hand methods. Then followed a period of great expansion beginning in 1916 and continuing until 1929. Today the automobile industry is in the period of stabilization.

Too New?

Television, on the other hand, can be classed as still in the experimental stage. Chemicals, to take another illustration, are on the steepest part of their life line. Coal appears to be on the down-grade while glass has found a new lease on life.

Big Profit Time

From the investment viewpoint your capital should be distributed mainly in those industries which are in the period of middle growth. They are beyond the promotional problems and yet are still not approaching the saturation dangers. It is the ideal stage in the life of an industry.

Check Your List

It is the profit zone for the corporation and its stockholders. It is the correct location for the bulk of your holdings. On the above chart decide where you would place the various industries in which you hold securities. When thus examined your investment portfolio should meet two tests.

Make Two Tests

First: Is your capital diversified over a reasonably broad range? Second: Are you well represented among industries which are in the period of greatest growth? Have you kept the majority of your funds out of raw industries on the one hand, and out of fading industries on the other?

A Three-Fold Plan

On Babson's Supervised List there are about 250 securities distributed over approximately 30 different industries. We recommend the purchase of those which we believe are timed for the period of rapid growth. There are others the sales of which we are advising at the present time.

Automatic Control

Under the Babson plan of Automatic Supervision, clients are not only told when we believe they should sell individual stocks and bonds but also when they should buy into an industry, and when they should get out of an industry.

Safety, Profit, Income

When you time your investment program by this three-fold plan you protect your principal, your profits and your income. The Babson Method gives you the benefit of more than thirty years' experience in the field of investment management.

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Send me details of your investment service, and current reports on business and investment outlook. Also complimentary copy of chart like the above, showing position of many major industries.

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Babson's Reports

THE TREND OF AFFAIRS

(Continued from page 186)

automobile the flexibility which was typical of steam and electric automobiles yet without the disadvantages that led to their being abandoned.

The fluid intermediary between motor and drive shaft cushions the whole driving mechanism from the engine to the rear wheels. Torsional vibrations originating in the motor are damped by the fluid. One other advantage especially cited is that the motor will not stall when it is in gear, even though car speed is suddenly cut down. Safety of operation in traffic, in crossing railways, and on hills is a result foreseen from this fact.

To Resume Research

THE only nonmagnetic ship in the world, the *Research*, which has been under construction at the behest of the British Admiralty to carry on surveying work which came to a halt when the Carnegie Institution's *Carnegie* was destroyed by explosion and fire at Samoa in 1929, is expected to be launched this month. The vessel is being built at the yards of Philip and Son, Ltd., in Dartmouth, England, and is scheduled to be ready for service next October.

Brigantine-rigged, as was her predecessor, the *Research* will have a full sail area of about 12,000 square feet. She will be equipped, like the *Carnegie*, with a specially built auxiliary motor. The new vessel is 142 feet in length, as against the *Carnegie's* 155.5, but will displace 700 tons, 132 more than did the earlier ship. Her cruising radius will be 3,000 miles, and her speed six and a half knots. She will differ again from the *Carnegie* in having rigging wires of aluminum bronze instead of the hemp used in the other vessel. The *Research's* anchors and cable will also be of aluminum bronze, and her hull will be built of teak. Packing cases made without iron nails, nonmagnetic metal containers for foods, and nonmagnetic kettles, razor blades, typewriters, tanks, oil drums, and other equipment will be used aboard her. Six officers, 22 petty officers and men, and four scientists will make up the personnel of the new floating magnetics laboratory when she finally puts to sea.

"Pedro"

MACHINES to reproduce speech have become commonplace to all of us and have strengthened each other's hands in recent years — as witness the stimulation of sales of phonograph records as a result of interest in music generated by radio. Now comes a machine not to reproduce, but to create, speech. In its first public appearance, before an audience of scientists at the Franklin Institute last month, the Voder not only went through a repertoire of animal sounds, ranging from the grunt of pigs to the tapping of woodpeckers, but engaged in brief conversational exchanges of complete sentences with its guardian, a representative of the Bell Telephone Laboratories, where the machine was developed.

The Voder, or "voice operation demonstrator," consists of apparatus used in everyday telephone service, coupled and powered in such a way as to provide the two basic sounds composing human speech — a hiss and a somewhat musical tone such as is heard in vowels — which are controlled by a set of keys and pedals regulating pitch and inflection and providing 23 different sounds from which the machine's speech is shaped at the operator's behest. Sometimes as many as five keys must be pressed at once to produce a desired sound. At least a year is required for the training of an operator, and those who have been thus trained still spend three or four hours a day in practice. They will use the machine to make synthetic speech as an exhibit at the New York and San Francisco world's fairs.

Developed specifically for this purpose, the Voder originated in the speech scrambler and unscrambler shown at the Harvard Tercentenary by the Bell Laboratories. It is described by O. E. Buckley, Vice-President of the laboratories, as a stunt outgrowth of a serious line of unannounced research. "Pedro" — as the device has been nicknamed in the laboratories in reference to Dom Pedro, Emperor of Brazil, who exclaimed, "My God, it talks," when the then newly invented telephone was demonstrated to him at the Centennial Exposition in Philadelphia in 1876 — is basis for the suggestion by Dr. Frank B. Jewett, '03, President of the laboratories, that the science of communication has now reached a stage of development permitting a man who has lost his voice to talk by merely punching a row of keys. As it is, though extensive training is necessary for the operator to amass a "vocabulary" of key and pedal movements, the Voder is said to equal practically anything the human voice can do, with a range from the lowest pitch of 80 or 90 cycles to overtones nearly up to 10,000 cycles. In the hands of an operator with sufficiently strong sense of musical tones and values, the machine can even sing.

FACTORY OR CATHEDRAL?

(*Continued from page 168*)

automobile manufacturer were to be forced to use a castle for a factory, or as if the church were to be obliged to use typical industrial establishments as cathedrals. Conceivably either could be done but not with entire satisfaction to anyone concerned.

And now though man is able to synthesize fibers, for some reason he has been content to process them according to the methods worked out over long periods of years for wool, cotton, or silk. He still confuses his factories with his cathedrals. Perhaps the reason is that the very age of the various textile processes leads to belief that they must be best methods and that therefore the best way to handle synthetic fibers is the ancient one. Another reason (and a powerful one) is the fact that a mass of processing machinery of established form and function is available. To carry out research as to the optimum way to handle synthetic fibers would be difficult and expensive and might well result in the necessity for the design, construction, and operation of entirely new machines.

Nevertheless, a very hopeful development in the production of fibers from test tubes is in the possibility that we may make filament of properties to satisfy the demands of a particular use. To this end everything that can be discovered about the growth and structure of the natural fibers is valuable information and will serve as background for the spinning of molecules of proper length, arrangement, and characteristics to serve best the desired end. This sort of (*Concluded on page 190*)

FACTORY OR CATHEDRAL?

(*Concluded from page 189*)

progress is not a dream, not an impractical vision. With the advent of the new filament, nylon, we have a material which has very different physical characteristics from any of the previously existing fibers. In the shape of its load-extension curve it more nearly resembles rubber. At low stresses it stretches relatively easily, while at higher loads the stretch becomes progressively less, until a small plastic flow immediately precedes failure. Thus usual stresses are not so likely to work havoc in milady's hosiery if it is made of nylon. Furthermore, the fiber of nylon is much stronger than that of rayon. In it no cellulose is used, but it does contain nitrogen, and to this extent simulates the animal fibers chemically.

The student who investigates fiber structure with a microscope only, is much like the building wrecker who dissects the gross elements of a building and measures the size, nature, and placement of the beams, columns, floors, walls, piping systems, wiring. If the student uses x-ray analysis, he more nearly resembles the laboratory technician who determines by analysis the structure of steel, the kind of wood, the composition of the brick or tile or stone. One type of investigator works with large structural units; the other, with their smallest components. In any case the analyst is tearing apart a finished structure.

If he approaches the problem from the point of view of the synthesist — and this is the angle of approach which must be used by the modern textile manufacturer — he may be like the artist who, given paints, brushes, and canvas, can combine pigment with fabric to produce a masterpiece; or he may be like a two-year-old child who, with the same materials, creates a first-class daub. What does the two-year-old lack that the great master possesses? The answer is: skill, vision, and knowledge. To gain these, we must drive research harder and farther.

AUTOMOBILE ANCESTRY

(*Concluded from page 170*)

Chicago.) The first of the 1875 models was found in his shop after his death, and came into the possession of the Austrian Automobile Club, who later gave it to the museum.

Even in his day Marcus had trouble with the police, who forbade the use of his second model on the public highway. Though what was too fast for the 19th Century would be too slow today, this crawling genesis foretold the modern car.

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TECHNOLOGY MEN IN ACTION

CHECK LIST OF THE ACTIVITIES AND ACHIEVEMENTS OF M.I.T. ALUMNI, OFFICERS, AND STUDENTS

Increased Responsibility

¶ For SAMUEL C. LIND '02, who has become president-elect of the American Chemical Society, to take office in 1940.

¶ For HENRY C. PATTEN '08, who has been appointed general manager of the Toronto Transportation Commission, effective January 1.

¶ For THOMAS C. DESMOND '09, who, in November, led the Republican ticket in winning reëlection for his fifth term as a member of the New York State Senate, receiving the largest plurality ever given a candidate from the Orange-Sullivan County district.

¶ For RUFUS E. ZIMMERMAN '11, who has been elected vice-president of the American Standards Association.

¶ For CHESTER L. KINGSBURY '18, who was elected president of the Toy Manufacturers of the U.S.A., Inc., in December.

¶ For JOHN DUFF, 3d, '35, who broke all vote-getting records in New Bedford, Mass., with a total of 27,297 to win the election as councilman-at-large in that city.

Footsteps

¶ Compared with 1935 (we couldn't lay our hands on the intermediate years) there is an especially large group of freshmen whose fathers are Alumni of the Institute. The following list presents the fathers in order of Class, with the son's name immediately following: ARTHUR LITTLE '01, Richard P.; KARL E. PEILER '04, William H.; EDWARD J. POOR '05, Leonard F.; LANE SCHOFIELD '05, William M.; HARRY W. BROWN '06, Russell W.; GEORGE A. CRANE '07, Russell A.; JOHN H. LEAVELL '07, Peter H.; TRACY SMITH '07, Tracy, Jr.; BENJAMIN W. PEPPER '09, Edward L.; MATTHEW POROSKY '09, Stanley M.; ARTHUR L. SHAW '09, Robert S.; F. SPENCER AREND '10, John S.; STERLING B. DYER '11, Donald P.; ROGER P. LOUD '11, Warren S.; NATHANIEL S. SEELEY '11, Franklin P.; FREDERICK H. DIERKS '12, Frederick M.; BOYD DUDLEY, JR., '12, William; HORACE B. FAY '12, Robert J.; WALLACE J. MURRAY '12, Wallace S.; JONATHAN A. NOYES '12, Jonathan H.; FRANKLIN HUTCHINSON '13 (deceased), Franklin; ALBERT M. JONES '13, Jack J.; PRESCOTT V. KELLY '13, George A., 2d; GEORGE E. LEAVITT '13, George E., 3d; WALTER C. EBERHARD '14, Walter S.; LOUIS A. WILSON '14, Duncan M.; FRANK J. HERLIHY '15, Francis B.; CLIVE W. LACY '15, John W.; ERNEST M. LOVELAND '15, John E.; GEORGE R. URQUHART '15, George R., Jr.; SANFORD L. WILLIS '15, Sumner C.; HOWARD T. EVANS '16, Howard T., Jr.; CHARLES W. LAWRENCE '16, Charles H.; JACKSON B. WELLS '16, Jackson B., Jr.; WILLIAM L. DENNEN '17, William H.; HAROLD C. NEUMANN '17, Gordon R.; GARDNER S. GOULD '18, Gardner S., Jr.; JAMES L. MCCLELLAN '18, James L., Jr.; ARTHUR J. MARSH '18, Arthur W.; RALPH SARGENT '18, Frederick; ANDREW I. MCKEE '21, Andrew I., Jr.; HARRY J. PALETZ '23, Harry J., Jr.; J. STUART CRANDALL '27, Paul S.

On the Platform

¶ FRANK B. JEWETT '03, President of the Bell Telephone Laboratories, a lecture at Rockford College, Rockford, Ill., under the auspices of the William Arthur Maddox Foundation, February 18.

¶ THOMAS R. CAMP '25, Associate Professor of Sanitary Engineering, two lectures on the hydraulics of water distribution systems, before the New England Water Works Association, November and December.

¶ FREDERICK K. MORRIS, Professor of Geology, a series of seven lecture-seminars on problems in geology. Dr. Morris has returned from a sabbatical year of travel, chiefly in Asia, and his lectures deal with such specific topics as "Volcanoes and Calderas in the Pacific Region," "Peninsular India," "Himalayan India," "The Granite Window of Aswan," and so on, November to March.

¶ LOUIS B. SLICHTER, Professor of Geophysics, lecture on "Applied Geophysics in the Job of Maintaining Our Mineral Reserves," before the Concord, Mass., chapter of the Unitarian Laymen's League, December 8.

Written

¶ By HARVEY S. CHASE '83, "Report Upon a Survey of the Financial Condition and Fiscal Transactions of the City of Winter Park, Florida, for the Last Year," submitted to the Property Owners Association in December.

¶ By CHARLES W. BERRY '95, CARL L. SVENSON '19, and H. CARLTON MOORE '24, "Problems in Engineering Thermodynamics and Heat Engineering," second edition, Wiley, New York City. Wiley says: "A book of problems that range from the simple to the complex, covering all the important phases of heat engineering. It is adaptable to any text being used, for symbols have been used as sparingly as possible, in order to allow for variations in different textbooks. . . ."

¶ By E. SHERMAN CHASE '06, "Sewage Disposal in Sandy Soil," *Engineering News-Record*, December 15.

¶ By HOLDEN C. RICHARDSON '06, "Back to the Catapult," the first of two articles on assisted take-off, *Aviation*, December.

¶ By HARRISON P. EDDY, JR., '17, "Cautions Regarding Land-Fill Disposal," *Engineering News-Record*, December 15.

¶ By WILLIAM F. HEAVEY '22, "Engineers in Chemical Warfare," *The Military Engineer*, November–December.

¶ By ROBERT B. LINDSAY '24, "The Future of Theoretical Physics," *Philosphy of Science*, October.

¶ By C. WINGATE REED '29, "Training Ordnance Reserves," *Army Ordnance*, November–December. This article "outlines the substance of a new Ordnance training plan for officers of the Arm and Service Assignment Group."

¶ By ROBERT S. HARRIS '28, JOHN W. M. BUNKER, Staff, and L. MALCOLM MOSHER '29, "Quantitative Measurement of the Ultraviolet Activation of Sterols. I. Ergosterol," *Journal* of the American Chemical Society, November.

¶ By HUNTER ROUSE '29, "Modern Conceptions of the Mechanics of Fluid Turbulence." For this paper Mr. Rouse was granted the Norman Medal from the American Society of Civil Engineers.

¶ By WILBERT B. MCCLUER '30 with J. T. Dickinson and H. O. Forrest, "The Application of Propane to the Manufacture of Pennsylvania Lubricating Oils," *Refiner and Natural Gasoline Manufacturer*, December.

¶ By the following members of the Society of Naval Architects and Marine Engineers, papers presented at the annual meeting in November: HENRY C. ADAMS, 2d, '15, "Some Notes on the Use of Models in the Study of the Rolling of Ships"; HAROLD E. SAUNDERS '16, "The David W. Taylor Model Basin at Carderock"; OLIVER D. COLVIN '24, "Care of Cargo at Sea"; HENRY A. SCHADE '28, "Bending Theory of Ship Bottom Structure"; DOUGLAS C. MACMILLAN '34 and A. S. Thaler, "Heat Balance Calculations for Marine Steam Plants."

Health Promoters

¶ From time to time in this column, The Review likes to group for its readers men who have a community of interest. We have done this for fire insurance men (June, 1938), and this time wish to present public health workers. This list is by no means complete; it refers exclusively to a breakfast during the convention of the American Public Health Association held in Kansas City in October: SAMUEL C. PRESCOTT '94, Dean of Science and Head of the Department of Biology and Public Health, M.I.T.; HENRY M. LOOMIS '97, National Canners Association, Washington, D.C.; CHARLES-EDWARD A. WINSLOW '98, head of the school of public health, Yale University Medical School; BURT R. RICKARDS '99, division of public health, Albany, N. Y.; ANNE ROGERS WINSLOW '04, New Haven, Conn.; RALPH E. TARBETT '05, senior sanitary engineer, United States Public Health Service, Washington, D.C.; JOHN F. NORTON '06, chief bacteriologist, Upjohn Company, Kalamazoo, Mich.; HARRY A. RAPELYE '08, Kansas City, Mo.; WILLIAM F. WELLS '09, department of bacteriology, University of Pennsylvania Medical School; JOHN H. O'NEILL '10, sanitary engineer, New Orleans, La.; FRANK J. OSBORNE '12, health officer, East Orange, N.J.; LEONARD M. SANDSTON '12, Pittsburgh, Pa.; GAIUS E. HARMON '13, director of vital statistics, Detroit, Mich.; HOMER N. CALVER '14, secretary of committee on medicine and public health, New York World's Fair 1939; THOMAS J. DUFFIELD '14, director of vital statistics, New York City; JOEL I. CONNOLLY '16, sanitary engineering department, Chicago, Ill.; AIMÉ COUSINEAU '16, sanitary engineer, Montreal, Canada; MURRAY P. HORWOOD '16, Professor of Bacteriology and Municipal Sanitation, M.I.T.

CLAIR E. TURNER '17, Professor of Biology and Public Health, M.I.T.; JAMES C. IRWIN, JR., '18, Kansas City, Mo.; MILLARD KNOWLTON '18, state department of health, Hartford, Conn.; LESTER V. CHANDLER '19, health department, Hackensack, N.J.; ALFRED H. FLETCHER '21, sanitary engineer, Memphis, Tenn.; CHARLES L. POOL '21, sanitary engineer, Providence, R.I.; KEBLE B. PERINE '22, health department, Belmont, Mass.; WILLIAM H. PICKETT '22, health officer, St. Petersburg, Fla.; JAMES WALLACE '22, American Public Health Association, New York City; EDMUND G. E. ANDERSON '23, state department of health, Providence, R.I.; MILTON E. PARKER '23, director of production, Beatrice Creamery Company, Chicago, Ill.; BERNARD E. PROCTOR '23, Associate Professor of Food Technology, M.I.T.; DAVID A. MEEKER '24, Vice-President, The Hobart Company, Troy, Ohio; BENJAMIN V. HOWE '26, sanitary engineer, Denver, Colo.; GEORGE B. DARLING '27, comptroller, W. K. Kellogg Foundation, Battle Creek, Mich.; SARA A. SCUDDER '27, research, health department laboratory, New York City; CLARA F. SMYTH '27, Laboratory of Hygiene, Philadelphia, Pa.; WILLIAM H. GAUB '31, director of laboratories, state department of health, Nashville, Tenn.; JOHN T. R. NICKERSON '32, Boston, Mass.; LEIGHTON R. RICKARDS '33, New York City; RALPH O. BROWN '34, health officer, Saginaw County, Mich.; B. RUSSELL FRANKLIN '34, health officer, Ingham County, Mich.; HOWARD E. LIND '37, director of health laboratory, St. Louis County, Mo.; LLOYD K. CLARK '38, sanitary engineer, Bismarck, N.D.; EDGAR J. STAFF '38, state department of health, Providence, R.I.

DEATHS

* *Mentioned in class notes.*

¶ CHARLES H. BRECK '70, December 29. The Boston *Evening Transcript* of December 30 says: ". . . Mr. Breck, for many years a resident of Newton, was born in Boston, a son of Charles Henry and Frances Augusta Brown Breck. He received his early education in the Boston public schools and later entered the Massachusetts Institute of Technology. . . . Since his retirement in 1922 he had continued his interest in agriculture and research. Active in the development of new processes, he often conducted experiments in this field for his own pleasure. Mr. Breck, who was the founder and first president of the New England Seedmen's Association, also belonged to the Massachusetts Horticultural Society, the Seed Trade Association, and the Brae Burn Country Club. At one time he was a director of the old Atlantic National Bank. He leaves his widow, Mrs. Marion Adams Breck. . . ."

¶ NORMAN S. WOOLDRIDGE '86, September 29.*

¶ WALTER G. WHITMORE '87, November 30.*

¶ JOSEPH P. NEWELL '88, December 5.*

¶ NORMAN P. WORK '88, November 30.*

¶ CLAYTON W. PIKE '89, December 31. From the New York *Times* of January 1, we quote: ". . . Born at Fryeburg, Me. . . . he was educated at Massachusetts Institute of Technology and came to this city [Philadelphia] in 1890, serving as an instructor in electrical engineering at the University of Pennsylvania for two years. He had been associated since 1923 with the Philadelphia Rapid Transit Company. Major Pike during the World War served in the Ordnance Department of the army. He was author of books and articles on electrical engineering and lighting effects and had been employed by many municipalities and private concerns. He was a former president of the Engineers Club here and was a member of the International Society of Municipal Electricians, American Institute of Electrical Engineers, Society of Illuminating Engineers and Society of Municipal Engineers. Surviving are his widow, the former Margaret E. Rattoo, of this city, and a daughter, Helen Margaret Pike."

¶ WINTHROP COFFIN '90, December 2.*

¶ ASA H. MORRILL '92, December 20.*

¶ JOHN L. NISBET '94, December 21.

¶ GEORGE DEFREN '95, December 26.

¶ EDWIN S. DODGE '97, December 10.

¶ CARLETON KOCH '98, December 25.

¶ PAUL MCJUNKIN '98, December 22.

¶ HERBERT H. KENNEDY '01, October 24.*

¶ CHARLES S. THOMAS '02, November 20.

¶ GEORGE TURNER '05, November10.

¶ PAUL B. WEBBER '06, December 25.

¶ PETER F. MCLAUGHLIN '08, October 5.

¶ PHILIP HART '10, November 29.*

¶ DAVID HUNTING '12, December 7.

¶ GEORGE STICKNEY '16, January 1.

¶ IRVIN GEROFSKI '23, December 20.

¶ MARCEL J. ALLINCKX '27, May 27.

¶ CYRIL MEAGHER '28, December 22.*

NEWS FROM THE CLUBS AND CLASSES

CLUB NOTES

Technology Club of Eastern and Northern Maine

The fall dinner meeting of the Club was held on the evening of December 8 in the English Room of the Bangor House. The Club was very fortunate in having as guest speaker Karl T. Compton, President of the Institute. Dr. Compton gave a very interesting talk on recent developments at Technology, illustrating his remarks with slides of the new Rogers Building, scale models of the new field house, and many shots of various research activities in progress. After his talk, Dr. Compton answered questions from the members present regarding affairs at the Institute. Our President, Franklin E. Bragg '97, acted as toastmaster.

Those present were Franklin E. Bragg '97, Carl E. Danforth '05, Gertrude E. Ebbeson '33, Frank A. Knight '38, Charles G. Paine '15, William C. Peters '02, Edward Vivian '38, and Roy P. Whitney '35, all of Bangor; Howard T. Clark '23 and Winthrop E. Robinson '32 of Dover-Foxcroft; Earl F. Bennett '30, Matthew E. Highlands '34, Arthur E. Keay '26, Fred L. Lamoreau '38, Alpheus C. Lyon '04, and Clayton D. Mersereau '38 of Orono; David Landen '30 of Presque Isle; and Elmer C. Warren '26 of Waterville. — Roy P. Whitney '35, *Secretary*, M.I.T. School of Chemical Engineering Practice, Eastern Manufacturing Company, Bangor, Maine.

Detroit Technology Association

A vital subject was discussed at our December dinner at the University Club. F. X. Martel, President of the American Federation of Labor in Detroit, talked with us touching on the A. F. of L. policies toward the Wagner Act, the National Labor Relations Board, the sit-down, and the Committee for Industrial Organization. After Mr. Martel's talk there was a question and answer period. — John E. Longyear '26, *Secretary*, 2000 Second Avenue, Detroit, Mich.

Technology Club of Hartford

The 1938–1939 season of the Club opened November 17 with a dinner meeting at the University Club. The evening was devoted to a survey of the problems of flood control in the valley of the Connecticut River. Robert J. Ross '06, city engineer of Hartford, outlined the activities of municipal forces and the W.P.A. in raising and reinforcing Hartford's dikes during the September flood. Motion pictures taken during this work bore witness to a close race with the rising water and were ample evidence of an excellent performance. Following Mr. Ross, Professor Edward L. Troxell of Trinity College described and contrasted the various proposals that have been made for the development of an adequate flood-control system for the Connecticut. The pros and cons of storage reservoirs, dikes, and by-pass canals were examined in an interesting talk which Professor Troxell illustrated with color slides.

On December 13 the Hartford group met to hear William J. Cox, highway commissioner of the state of Connecticut, who spoke on "Highway Department Activities and Plans." After a concise survey of his subject, Mr. Cox turned the meeting into an open discussion, in which the art of designing highways was examined from all possible points of view.

The Club has thus begun what we believe will be another successful year. Interest among local Alumni is on an upward trend, as indicated by a 40 per cent increase in paid memberships above the preceding period, which is due in part, no doubt, to a rather severe reduction in the annual dues. — Thomas B. Rhines '32, *Secretary*, United Aircraft Corporation, 400 South Main Street, East Hartford, Conn.

Technology Club of Milwaukee

A dinner meeting of the Milwaukee Alumni was held on December 8 at the Eagles Club. The guest speaker was Edward Halbach, the President of the Milwaukee Astronomical Society, who addressed us in a most entertaining and instructive manner. This society is known in the world of amateur astronomy for its real contributions to voluntary research in coöperation with organized groups throughout the country, in such fields as variable stars, meteors, and so forth. We are indebted to Mr. Halbach for an interesting evening.

Our President, L. D. Smith '06, contributed in no small way to making the occasion one of *gemütlichkeit*, as well as education and entertainment.

We invite any M.I.T. man who visits Milwaukee to make himself known to us by phoning the Secretary at WEST 8308. Our mailing list is kept as up to date as possible through the help of the unusually efficient services of the Alumni Office in Cambridge but necessarily depends also upon the coöperation of our members in keeping us informed as to their changes in address and as to new residents in Milwaukee and vicinity. — Robert M. Osborn '36, *Acting Secretary*, 2840 Highland Boulevard, Milwaukee, Wis.

Technology Club of Schenectady

A dinner meeting at which Dean Prescott '94 gave a very interesting informal discourse on "What Is New at Tech" was held on December 6. Slides of some of the more recent changes were shown and assisted greatly in giving those present a visual impression of the changes being made. — Harris A. Thompson '33, *Secretary*, General Engineering Laboratory, Building 5, General Electric Company, 1 River Road, Schenectady, N.Y.

Worcester County Alumni Association of the M.I.T.

The annual fall dinner was held on November 30 at the Hotel Bancroft, with 64 members and guests attending. R. Merwin Horn of the M.I.T. Photographic Service gave a demonstration of the technique of high-speed moving pictures and showed some of those developed at the Institute. The next meeting of the Club will be in the latter part of this month, the date to be set by the executive committee.

Charles E. Locke '96, Alumni Secretary, brought the greeting of the home association to our local group and told of the progress being made on the construction of a new athletic field and gymnasium. Robert H. Brown '22 of Leominster, newly elected President of our Association, presided. The committee consisted of John A. Swift '27, chairman, George D. Manter '31, Orville B. Denison '11, all of Worcester; W. Sargent Crowell '32 of Fitchburg; Robert J. Proctor '28 of Leominster; and Carl H. Wilson '34 of Southbridge.

Others present were W. Franklin Baxter, Jr., '34, Erving G. Betts '18, Gordon W. Browne '29, Robert G. Clarke '35, Percy J. Colvin '07, Daniel P. Dyer, Jr., '32, Albert A. Gordon, 3d, '23, Ralph F. Gow '25, Robert N. C. Hessel '27, Frank C. Howard '17, Albert J. Hoyt '14, William A. Hyde '04, Arthur W. Johnson '14, Forrest F. Lange '23, Harry M. Latham '93, Oscar T. Marzke '32, Norman C. Nelson '30, Philip L. Ober '36, J. Weston Pratt '24, Albert J. Puschin '28, Carleton A. Read '91, Harold L. Robinson '11, Howard R. Stewart '17, Henry R. Tomlinson '22, Louis E. Vaughan '02, Lewis S. Vose '16, Ernest P. Whitehead '20, and William A. Wilder '98, all of Worcester; Howard F. Atwood '32, Bolton; Joseph Goodwin '30, Clinton; Angelo M. Altieri '29 and Andrew B. Sherman '06, Fitchburg; Roderic L. Bent '19 and his son, Gardner L. Bent, Harold O. Berry '22, Stanford H. Hartshorn '11, Henry E. Heywood, Jr., '37, Thomas P. Kelly '18, Harry S. Kendall '04, and Roger R. Smith '27, all of Gardner; William P.-G. Hall, Jr., '32, Lancaster; Edward Earl '91, Leominster; Ralph G. Mahony '18, Sterling; Arthur G. Anderson '30, Southbridge; F. Eugene Banfield '07 and Philip B. Walker '07, Whitinsville; Morey Eames, Peterboro, N. H.; Roger W. Wight '01, Hartford, Conn.

Also present were the following guests: Frank Bottomley, F. H. Cutting, James O. Fenner, Victor Sepavich, Roger B. Tarbox, and Walter H. Wakefield, all of Worcester, and H. C. Rudderhans of Fitchburg. — JOHN A. SWIFT '27, *Secretary*, 1156 Pleasant Street, Worcester, Mass.

CLASS NOTES

1886

The following in memoriam was prepared by The Edward A. Woods Company of Pittsburgh: "One of the greatest figures of the life insurance business in Pittsburgh is no longer with us. Norman S. Wooldridge, for more than 35 years a member of this agency, passed away in Haverford, Pa., last evening [September 29]. Everyone who knew and worked with Norman Wooldridge felt the worth of the man and benefited by each contact with him. Kindly, courteous, and considerate, and yet of strong character, Mr. Wooldridge exemplified the gentleman in every sense of the word. His contributions to this agency, great though they were in business secured, cannot be measured by production alone, for his interest in the welfare of The Edward A. Woods Company and all those associated with it transcended any selfish impulses. To all who worked with him he gave his best. His honors and distinctions were many. He was one of the first directors of the agency and served in that capacity for many years. He served as president of the agency's Century Club, the old Equitable Lunch Club; and repeatedly was honored by appointments and offices of responsibility and trust.

"For several years prior to his affiliation with this agency, Mr. Wooldridge was identified with the Penn Mutual Life Insurance Company; and prior to that with the Mutual Life of New York, of which company his father had been general agent for many years. Coming here in May, 1903, he qualified that year for the $300,000 Club, and year in, year out, his was an outstanding record of personal production. More important than volume alone, large though it has been, was the character of the business which he wrote. His clientele was of the best. With a delightful personality and warm capacity for friendship, he worked among men who admired, respected and liked him and who had confidence in his ability. His coöperation in all ways in this agency will long remain a cherished memory. We have lost an able associate and a very dear friend. . . ." — ARTHUR G. ROBBINS, *Secretary*, 12 Grove Street, Winchester, Mass.

1887

The Secretary, having received a much more extended and complete account of the career of our late classmate, Walter Sherman Moody, than that given in the January Review, submits it for the information of his classmates. The following is from a Pittsfield paper of November 7: "Walter Sherman Moody, 74, one of the six original engineers of the General Electric Company, who had charge of all transformer design for the entire company from 1892 to 1927 when he was made consulting engineer, died this morning at his home, 155 Dawes Avenue, after an illness of several months. He had been retired since 1931, after 43 years service with the G.E. Mr. Moody, in an electrical engineering carreer that extended over a period of fifty years, contributed much to the electrical industry by his inventions and research. He was granted seventy-five patents on transformer constructions, some of which are widely used in modern installations. In addition to his researches in the metallurgy of copper and magnetic steel, he was the first, in connection with Sir Robert Hadfield, inventor of silicon steel alloys, to produce silicon steel in large quantities in thin sheets.

"He was born in Chelsea, Mass., on September 20, 1864, and received his engineering education at the Massachusetts Institute of Technology, where he was a member of the first graduating class in electrical engineering, in 1887. After serving as an instructor in electrical engineering and physics at the institute for one year, he became assistant engineer for the Thompson Welding Company, of Lynn, Mass. He resigned in 1893 to become designing engineer for the Thompson-Houston Electric Company, and when that company was consolidated with the General Electric Company he began to devote all his time to the design and manufacture of static transformers. He was transferred to the Schenectady, N.Y., plant in 1897 and remained there until 1908, when he was sent to the Pittsfield, Mass., branch.

"Under his management as chief engineer of transformer design and manufacture, the Pittsfield plant became the company's headquarters for transformer production and the largest factory of its kind in the world. For several years before he was retired from the company he was consulting engineer for the entire transformer department, which included works at Lynn and Pittsfield, Mass.; Erie, Pa.; Fort Wayne, Ind.; and Oakland, Calif. As a youth he was a member of the Massachusetts Naval Militia, which he joined when it was formed, and served in a company of which John W. Weeks, later United States Senator and Secretary of War, was captain.

"An original member of the Quarter Century Club in Pittsfield, he served as the organization's second President for a two-year term. He was also an original member of the local section of the AIEE and was a fellow of that organization, as well as a member of the National Electric Lighting Association, and the Electrochemical Society, the Engineering Society of Western Massachusetts. He was a member of the First Congregational Church. Mr. Moody is survived by his widow, one daughter, Mrs. Guglielmo Camilli, whose husband is also an outstanding electrical engineer at the local plant, and a brother, Dr. Herbert R. Moody, Professor of Chemistry at the City College of New York."

On November 30 last the Class suffered the loss of another member, also a distinguished electrical engineer, Walter Gray Whitmore, who passed away at his home in East Orange, N.J. His widow has furnished the following sketch of his career: "Walter Gray Whitmore was born in Plymouth, Mass., in 1865, and was graduated from the M.I.T. in 1887. He went to Chicago with the test department of Leonard and Isgard, western agents for the United Edison Company. In May, 1888, he went to the Chicago Edison Company, remaining there until June, 1889, at which time he went with the United Edison Manufacturing Company, New York City. During his association with the General Electric Company he held the position of district engineer and assistant engineer in the New York office. In 1911 he was made manager of the order department and from 1924 until 1931 was commercial engineer of the railway and central station departments. He retired from active business in 1931. The last 28 years of his life he resided in East Orange, N.J.; prior to that, in New York City and Brooklyn. He is survived by his wife, Kathryn M. Whitmore; a daughter, Mrs. Thomas F. Keefe; a son, H. Bruce Whitmore; and a granddaughter.

Arthur Nickels writes from Bath, Maine: "One day a few weeks ago I had turned on the radio when word came in that George O. Draper had passed on. What a colorful life he lived! And how much he enjoyed living and how much he was enjoyed by those who had the privilege of knowing him! I expect to go south again soon after Christmas. . . ." Later we heard from Nickels that he is at 124 West 9th Street, Sarasota, Fla., where he will remain through April.

Frank Salmon (formerly Solomon) sent an interesting letter to the Secretary, who located him in Daytona Beach a short time ago, as was noted in the January Review. Frank says: "While it was a part of your routine as secretary of the Class, still I was mighty glad to hear from you. We were fairly closely associated at Tech. My, but that was some time ago! Occasionally some of the men I know or meet mention their college class. All of them are surprised that mine was '87. I look much too young for that, and I think I feel as young as they do, even if their class was a dozen or 15 years later. That's what Florida sunshine will do if the treatment is not begun too late. Your letter brought to mind many of the old M.I.T. classmates — some very fine men. There are none in this section that I know of. One man who started with '85 and finished with '86 has lived here for years. He inherited from his father one of the old Spanish land grants and, from other members of the family, much other property. At the time he was at Tech the family home was in Cincinnati, although they came here winters. Some years ago, knowing I hailed from Boston, he mentioned that he was a Tech man. I told him that I was, too, and asked his class year. His reply was that it must have been so many years before mine that there

1887 Continued

could be no chance for any mutual acquaintance. But I was able to recall the one or two in our Class who came from Cincinnati. He remembered them.

"Outside of regaining my good health, and keeping it, my record here has been far from brilliant. Real estate was almost the sole topic of conversation. Everybody dabbled in it. I was told I should get into it, and, after over a year spent in getting well and looking — without success — for something else that could with my very limited capital be tackled with some degree of safety, I finally came to the same conclusion. Did very well until the Florida land boom collapsed in the winter of 1925–1926, which was followed soon by the bank failures. That put me and thousands of others (all over Florida) on the rocks. The stock market crash of 1929, just when Florida was beginning to come back, was another blow. It was tough sledding. A little improvement in 1936, but last year we felt the effects of the recession very keenly. How I have been able to maintain the appearance of being so much younger than I really am is a conundrum, for I have been through enough to have just the opposite effect. Mrs. Salmon, too, in spite of having been afflicted with arthritis for the last 12 years, much of the time subject to severe aches and pains, keeps up her courage and hopes that good times will come before it is too late for us to benefit from them.

"I presume the roster of the Class has shrunk materially. A good many had died the last time I knew anything about it. It goes without saying that I would be very glad to hear from you any time the spirit moves — better still, to see you here the coming winter. Say hello for me to any of the boys of the Class — now living on borrowed time — when you see them. Probably some of them come to Florida winters. Would be glad to see them. I am easy to find. Almost everybody — except the newest newcomers — knows me."

With this issue, we conclude Brainerd's travelogue: "Wherever we went in the Western country, we were impressed that geological changes were much more prevalent than on the Atlantic slope or in the Mississippi basin. The mountains are rising faster than erosion cuts them down. Earthquakes seem to be the readjustment of the earth's layers to these changes of level. A rechecking of the difference in elevation between the valley of the San Joaquin and the crest of the Sierras after a recent quake showed an increase of about 25 feet. One night at Carmel there was a tremendous shaking of our cottage, and we thought that we were experiencing one of these readjustments.

"There was only one shake, so we went to sleep again. Next morning we found that our shake was only a little private quake of our own. Our son had forgotten the steps down in the corridor connecting the two portions of the cottage and his unexpected drop onto the light floor framing had given us a very good imitation of a quake.

"Three things which we saw between Los Angeles and San Francisco stand out in my memory. The beauty of Santa Barbara as seen across the gardens crowning the mountain to the north; the city spread over the plain sloping to the sea; the peaceful waters of the channel and the mountainous islands closing the view to the south. The extent and grandure of the shore drive extending from Morro Rock for 145 miles up to Carmel; it so far exceeds the famous Corniche near Nice. The length of time that Nature takes to work out her problems, as seen in the redwoods of the Santa Cruz grove; that these trees, some of them 5,000 years old, are the continuation by offshoot, not through seed, of trees that occupied this same ground from 100,000 to 200,000 years ago. The new bridges at San Francisco are working wonders in bringing the cities around the Bay together. For instance we drove from the gates of Stanford University in Palo Alto to our house on Dimond Canyon, Oakland, in 45 minutes without exceeding any speed limits; this is but little more than the time required for the ferry between the San Francisco and Oakland piers.

"From Oakland we turned homeward, touching most of the usual sights. The visit to Boulder Dam gave me an entirely new conception of its purpose. It appears that the Colorado River drains one-seventh of the United States. The soil in this basin is easily washed, and the rainfall torrential. Frequently the flow in the lower course of the river is about as much silt as water, and floodwater comes when it is not needed for use. The lake it creates is a regulating and settling basin. The generation of electric power is simply a fortunate incident which promises to pay the entire cost in about 50 years. Besides, the dam will save the farmers of the Imperial Valley some million dollars a year in the cost of maintaining their irrigating ditches. The engineers estimate that the lake created by the dam is of sufficient size to store the silt brought down for 200 years. Since the fertility of the Imperial Valley is due to just such silt deposited over it, I am wondering why this deposit may not be used to enrich other land.

"Approaching the Grand Canyon from Williams, the road rises some 1,200 feet in the 57 miles. All drainage from the south rim is away from the canyon, and there are no side canyons. The general slope of the plateau increases across the canyon, totaling some 1,250 feet in the 13 miles of its width; the plateau continues to rise beyond the canyon, so that all drainage on the north rim is into the canyon, producing numerous side canyons. Apparently the river had established its course as the plateau began to rise and has sawed and chiseled its way through the strata as they have risen, gouging out the canyon across this plain of fairly uniform slope. The elevation of the south rim is 7,000 feet, with climate and seasons about like southern New England. The elevation of the river is 1,700 feet with a subtropical climate. The elevation of the north rim is about 8,300 feet, with a climate like Canada. Thus small portions of the same strains of animal and vegetable life have been isolated and subjected to gradual change in climate and other incidental conditions. How complete this isolation may have been is shown by the discovery by Kolb brothers of a small tribe of Indians, in a north-rim side canyon, who had never before seen a white man or been down to the main river until they carried in supplies for the explorers. Thus a trip down through and across the canyon gives a chance for the study of evolution in process and a cross section of geological strata from 5,000 to 6,000 feet high.

"A place to study the evolution of human institutions is among the pueblos. Several of the present villages have had a ontinuous existence of 600 to 800 years, and there are ruins that go back more than 1,000 years. I had supposed that these villages were all of one tribe. I learned from the anthropological laboratory at Santa Fe that, while the American Indians are all of one blood, they speak over 500 different and mutually unintelligible languages. These are classified in 12 great groups, which differ among themselves as much as English and Chinese. In the 18 pueblos are found representatives of six of these great groups. While their general mode of life is similar, each group has worked out its own customs in communal living. At Isleta, I made the acquaintance, in her father's shop, of a 12-year-old schoolgirl, who was just completing the work of the first six grades. She spoke Isleta and correct and fluent English but could not understand her mother's native tongue of Laguna, a pueblo 40 miles away. Contrary to the matriarchal custom of her pueblo, she appeared to be reckoned as a member of her father's, not her mother's, clan. Thus is the melting pot at work even among the pueblos."

Several of the other fellows have been heard from of late, but their letters were mostly of a personal nature and expressed regrets at their lack of news for publication. However, we hope to have a few items, at least, for March release. — NATHANIEL T. VERY, *Secretary*, 15 Dearborn Street, Salem, Mass.

1888

It is my sad duty to record the passing of Joseph P. Newell on December 5 in Portland, Ore. He was one of the best-known civil and railroad consulting engineers in the Northwest. He entered the Institute with out Class in 1884 from Mount Tabor, Oregon. He started business with the Oregon Railroad and Navigation Company and by 1907 had worked his way up through the engineering and construction department to division engineer, maintenance of way. He then founded the firm of Newell, Carter and Walsh, consulting engineers, in Portland, with which firm he was connected for 31 years, until his death. The company was engaged in general engineering practice, railroads, irrigation, power work, and valuation. They did the engineering work for the Northwestern Electric Company

1888 Continued

of Portland and built the municipal docks at Astoria. Newell was consulting engineer for the Oregon Public Service Commission and the Canadian Northern Railway Systems. In 1919 he was president of the Portland city planning commission. In 1920–1921 he was employed by the Canadian government in the arbitration proceedings over the Grand Trunk Railway.

Newell was a member of the American Society of Civil Engineers, Oregon Society of Engineers, Portland Chamber of Commerce, and of the Portland Realty Board. He was married in 1892 and had one son. About one month before receipt of notice of Newell's death, your Secretary received a letter from another '88 civil, Albert J. Perkins of Santa Ana, Calif., stating that Mrs. Newell had recently passed away. George Roper, as well as Perkins, was a chum of Newell while in Technology; each of them traveled to Oregon to visit him within the last few years. Newell was the kind of man whose friendship grows stronger as the years pass. His memory will linger with us.

Smoky Joe Wood told us at our 50th reunion that a roll call in one of his freshman sections ended with Webster, Wood, Work, and Wright; now we have to report the death of Norman P. Work on November 30 in Yonkers, N.Y. Work was with us only during our freshman year and was one of seven who made their first appearance at a class reunion last June at Marblehead after an absence of 54 years. He made up for lost time by telling interesting stories of his past life during our three days' stay at Marblehead, as all will remember. He left two sons and two daughters, as well as his wife. One of his daughters-in-law wrote Fred Wood at the request of Mrs. Work to notify the Class of his death. She states that he had been very well up to the day before, going out as usual, but he suffered an acute heart attack, was taken to the hospital, and passed on within a few minutes. Work, like Fred Nichols, was a retired teacher. After leaving Tech he took a course at Teachers College, Columbia University. He taught mechanical drawing and shopwork and also was educational secretary of the Hartford (Conn.) Y.M.C.A. He retired two years ago. Mrs. Work and the four children, now in Yonkers, are grateful that he did not have long to suffer and that he had such a useful and active life. He was one of the most active at Marblehead last June, and we will not forget him soon.

The Class of '87 set a good example for us during our three years together at Technology, and now after 50 years we followed her example again by selecting Marblehead for our 50th. We wish to express herewith our appreciation to Nathaniel T. Very, Secretary of '87, for recommending Marblehead to us and to say that it surpassed our expectations. We quote the last paragraph of Very's recent letter to us, with our emphatic approval: "To my mind, the old days of horsecars, comic opera, and sessions at the Old Elm held a charm unknown to the present generation." — BERTRAND R. T. COLLINS, *Secretary*, 16 Chauncy Street, Cambridge, Mass.

1890

The death, on December 2, of Winthrop Coffin, who spent two years with us in Chemistry, is reported. After leaving Technology he became interested in the chemical business and continued for several years, transferring then to the electrical industry with the Thompson Houston Electric Company, which later became a part of the General Electric. He remained with them until 1898, when he resigned to help found the firm of Perry, Coffin and Burr, which specialized in bond issues of electric public service corporations. At that time a resident of Auburndale, Mass., he helped develop the old Newton Street Railway Company, of which he became president. He was also a trustee of the Boston Elevated for many years, terminating this because of ill-health in 1928 when he retired. After this he became interested in the restoration of early Colonial houses in Massachusetts, especially that of the Jethro Coffin House at Nantucket which was done by the Society for the Preservation of New England Antiquities.

The address of William B. Poland is changed to 1675 31st Street Northwest, Washington, D.C. — GEORGE A. PACKARD, *Secretary*, 50 Congress Street, Boston, Mass. HARRY M. GOODWIN, *Assistant Secretary*, Room 4–136, M.I.T., Cambridge, Mass.

1892

Arthur Dean, chief engineer of the Massachusetts State Planning Board and a director of the American Society of Civil Engineers, was the recipient of honorary membership in Tau Beta Pi, national engineering fraternity. He gave a talk on engineering ethics at the initiation ceremony held at the University Club in Boston on November 29. Tau Beta Pi selects its members for scholastic attainment and participation in activities. The candidates are chosen from juniors and seniors enrolled in the engineering courses at M.I.T.

Herbert Moody, many years a member of the staff in chemistry at the College of the City of New York, was retired in September as an emeritus professor. He is now chairman of the division of chemistry and chemical technology of the National Research Council, with headquarters in Washington. His home address is Windover Heights, Vienna, Va. He reports that all is well with him and his family.

The newspapers report the death of Asa Hall Morrill at his home in Portland, Maine, on December 20. Morrill had been chief engineer of the Boston and Maine Railroad, the Maine Central Railroad, and the Portland Terminal Company. He was one of the best-known railroad officials in New England. He was born in Concord, N.H. After graduation from M.I.T. he entered the railroad service as an assistant engineer of the Buffalo, Rochester and Pittsburgh Railway. Within a year he transferred to the New York, New Haven and Hartford and after two years became assistant roadmaster of that road. In 1907 he joined the Maine Central and in 1928 was named chief engineer. His residence was in Portland, and he leaves a wife, Elizabeth, and a daughter, Marjorie. — JOHN W. HALL, *Secretary*, 8 Hillside Street, Roxbury, Mass. W. SPENCER HUTCHINSON, *Assistant Secretary*, Room 8–219, M.I.T., Cambridge, Mass.

1896

Admiral Bakenhus has again been honored by the Alumni Council by being renominated a member of the Departmental Visiting Committee on Mathematics at M.I.T. The Myron Fullers have now arrived back home from their very interesting trip. The Secretary has had the pleasure of reading the account of this trip as it appeared in successive issues of the Brockton *Enterprise*. The facts that the Fullers visited out-of-the-way places and that they are both keen observers added to the interest of the story. They followed along the Dalmatian Coast and actually were in the countries of Italy, Yugoslavia, and Albania. One particularly fascinating place which they visited on their various shore trips was Ragusa in southern Dalmatia, Yugoslavia, on the east side of the Adriatic — an old city retaining many features of medieval days.

Through Joe Knight, who lives in Pittsfield, and other sources, the Secretary has learned of the death of William L. Root, who passed away suddenly in his shoe store in Pittsfield on Wednesday morning, November 9. He had been in excellent health, and it was said that the first one to find him was his mother, who called at the store that morning to make one of her periodic visits from her home in Lee, Mass. Root was born in Pittsfield on October 23, 1875, the son of Henry Allen and Annie Lacy Root. On June 22, 1910, he married Miss Mary Louise Denny. One son was born on October 19, 1912 — William Lacy Root, Jr., who was of the Class of '35 at M.I.T. For two years after his graduation Root was with Dr. Gill '84 at M.I.T. as assistant in oil and gas analysis. From 1898 to 1901 he was instructor in science in St. Johns School, Manlius, N.Y., and from 1901 to 1903 he was instructor in science in the Newark High School, Newark, N.J. In 1903 he returned to Pittsfield to assist his father in their oldtime store of O. Root and Son, retail shoe dealers. Since the death of his father in 1922 he has carried on the business himself. It is interesting that Root still owned a portion of the original grant of a tract of woodland on West Mountain given to his greatgrandfather, Colonel Oliver Root, a distinguished soldier of the Revolutionary War and one of the original incorporators of Pittsfield. He was keenly interested in the Berkshire County chapter of the Sons of the American Revolution and had been its president and in more recent years its secretary. He was a member of the Pittsfield Chess Club. He

1896 Continued

was an attendant of St. Stephen's Church and for a number of years served as a lay reader, going to small churches in Berkshire County. He was the author of several local historical and biographical articles. The men of '96 will remember Root as a loyal Technology man and a '96 man who attended our gatherings and gave us his support. — CHARLES E. LOCKE, *Secretary*, Room 8–109, M.I.T., Cambridge, Mass. JOHN A. ROCKWELL, *Assistant Secretary*, 24 Garden Street, Cambridge, Mass.

1901

According to recent comments received from Bill Farnham, he is continuing to enjoy his retirement from business and states that last winter he and Mrs. Farnham motored to Florida and then over to New Orleans for the Mardi gras. Last summer Bill stated that he was traveling around New England and has recently left on a leisurely trip across the country with Pasadena as an objective, then to San Francisco for the Fair, finally returning East sometime in May. Pretty soft for these retired businessmen who have rightfully earned the privilege of taking it easy.

Another one of our retired classmates, Anna Billings Gallup, who was formerly curator in chief of the Brooklyn Children's Museum but who is now the emeritus curator in chief of that museum, is living with her brother at Chrisways, North Stonington, Conn. Miss Gallup writes that in addition to taking a very active interest in her brother's practical experiments in farming, she is active in a voluntary capacity in giving talks to interested groups in connection with the projection and operation of children's museums. As regards her brother's farm, Miss Gallup wrote that "it is a biological dynamic unit based on earthworm tillage, the result being that such soil treatment shows amazing results in stepping up crop production."

That brief comment excited my curiosity, and I therefore wrote to Miss Gallup for further information. She replied very interestingly as follows: "My brother has originated, and developed to a tractor-power basis, a system of farming that regularly utilizes earthworms, taprooted weeds, and soybeans to bring the abundant supplies of natural plant food, long dormant in the subsoil, up to the surface and there make them available to the standard farm crops. It takes three or more years to make the soil fully responsive, but then the yields are amazing. Three cuttings of clover per season are now standard here. The corn has yielded as high as 136 measured bushels per acre, although the hurricane damage kept the harvest down this year. It was also a bad year for potatoes generally, but those grown here yielded 13 bushels of choice tubers for each bushel of seed, which is some 10 per cent better than what the professional growers consider standard in Aroostook County, Maine. You understand that I am only an enthusiastic observer in much of this although there are out-of-doors occupations in which I can have a very enjoyable part. The hurricane blew farm properties around in a ruthless fashion, and uprooted and splintered most of the beautiful trees, but thankfully no lives were lost here and there was no suffering."

Others of our Class with small or large residential estates have undoubtedly made some experiments in the raising of plants and perhaps the story sent in by Miss Gallup may induce out-of-the-ordinary thoughts on such subjects. For example, Ted Lange, who now makes his home at 62 Massachusetts Avenue, Springfield, and is especially interested in real estate, has recently sent in a rather lengthy clipping with illustrations, which appeared in the Springfield *Republican* the latter part of October. The article described the very interesting and practical experiments in rose growing by another one of our classmates, Bob Montgomery, who with his brother has for a number of years been operating an extensive rose plant in Hadley, Mass., his company being known as the Montgomery Company, Inc. The newspaper account showed many interesting views of rose growing and even included a fair likeness of Bob himself engaged in the devoted care of his wonderful roses. The article itself, which is too long to be quoted in full, is certainly well worth reading by those interested in rose growing and may undoubtedly be obtained if request is made for the Sunday edition of the Springfield *Republican* which appeared on October 23.

This article does not speak of "earthworm tillage," but it does tell of the pioneering in the cultivation of roses by Bob's father who actually started the big rose plant at Hadley. The beginning was naturally small but the enterprise now has more than 95,000 different varieties of roses under glass, covering four and one-half acres, and each year approximately 2,500,000 roses are shipped to the Boston Flower Exchange. The packing of the roses so that they will safely survive the journey to Boston has to be very skillfully contrived, and that part of the business requires as much cleverness as in the original culture and growing of the roses. Bob and his brother and father have developed a number of wonderful roses, two of the very well-known varieties being the "talisman" and the "crusader," and there have been many more. If, therefore, any of the Class are interested in roses and in again renewing old friendship with Bob, we are certain that he will welcome any visitors to Hadley. Although many of us remember him as being rather quiet while he was at Tech, he will undoubtedly prove interestingly loquacious in talking about his special hobby and present business.

The Alumni Office has sent in the following changes of address: John R. Anderson, Jr., is now at 460 East Avenue, Rochester, N. Y.; Robert H. Brown is at 821 Prospect Place, Brooklyn, N. Y.; and William G. Blauvelt, another one of our fortunately retired classmates, is located for the winter at 246½ Seventh Avenue, Northeast, St. Petersburg, Fla. Clifford H. Shivers returned the "address wanted sheet" with the comment that Clarence Lincoln Brown, whose address has been missing for some time, is located care of Wark and Company, 1608 Walnut Street, Philadelphia.

Shivers who, we believe, is one of the members of the Ballinger Company, architects and engineers, 105 South Twelfth Street, Philadelphia, made no comments about his own interests or those of Clarence Brown, so your Secretary must be limited to this brief comment.

We are also very sorry to have to advise that notice has just been received from the Alumni Office of the death, on October 24, of Herbert H. Kennedy who was graduated in the Course in Electrical Engineering. About two months before that notice was received, the Alumni Office advised of Kennedy's change of address to Post Office Box 1312, East Hampton, N. Y. However, no other comments were given but will be gratefully received provided anyone who has recently contacted our old friend can tell us something of his business life and whatever else would prove interesting to include in these notes. — ROGER W. WIGHT, *Secretary*, The Travelers Fire Insurance Company, 700 Main Street, Hartford, Conn. WILLARD W. Dow, C.P.A., *Assistant Secretary*, 20 Beacon Street, Boston, Mass.

1906

These notes are being written three days before Christmas, and the natural impulse is to greet classmates with a "Merry Christmas." Upon further thought it is recalled that they will not be read until the first of February, so the best we can do is to extend a belated "Happy New Year." At this time of year, Mrs. Kidder and I are reminded of classmates by the many attractive Christmas cards received from '06 people. All of the '06 cards are looked over with a great deal of interest, and the Secretary appreciates the thoughtfulness of classmates in sending them.

News of living classmates is particularly scarce at this time, and your Secretary has nothing special to report concerning them. You will be interested and saddened to learn of the passing of three more on our list. Allen Ashley's death on June 8, 1931, has just been reported. Ashley was a member of Course VI, and ten years after graduation was associated with the Westinghouse Company in New York. No further information is available, as Ashley showed no interest in class affairs. — Fred S. Phelps, a graduate of Course II, died on October 17. In 1906 he was associated with the American Steel and Wire Company at Worcester. In 1910 he became the assistant superintendent of that company's rope mill in that city. Later, he was transferred to San Francisco and from 1915 to 1922 was the superintendent of the company there. In 1932 he affiliated with the Columbia Steel Company at San Francisco as general superintendent, which position he held at the time of his death. Phelps was married to Bertha J. Jones on October 22, 1912, and had no children. — Julian M. Wright died on October 6. Wright took Course XIII at the Institute and for

1906 Continued

a while after graduation was with the New York Ship Building Company at Camden, N. J. Later he studied law at the New York Law School and in 1916 was a member of the law firm of Ehlermann, Hale and Wright in New York City. The 1928 record reported him in Paris, France, and his last address, received in 1935, showed him in Cairo, Egypt. Further details are lacking. — JAMES W. KIDDER, *Secretary*, Room 802, 50 Oliver Street, Boston, Mass. EDWARD B. ROWE, *Assistant Secretary*, 11 Cushing Road, Wellesley Hills, Mass.

1907

From A. T. Kolatschevsky, Lanteernhof Straat, 113, Deurne-Zuid, Belgium, under date of November 17, we received the following brief message: "I was glad to receive your welcome letter of October 30. This time I'm afraid I have but little to report or to add to what I wrote in my last. Nothing very extraordinary seems to have happened to me or mine excepting perhaps the fact that our hair is not so dark as it used to be 30 years ago. I am still busy at my telephones and writing plays for a hobby. With kindest personal regards and a cordial shake of the hand to the fellows. . . ."

In order to bring you readers up to date regarding our classmate, here are facts given in a report from him in September, 1935. From 1909 to 1911 he was engineer with Bell Telephone Manufacturing Company at Antwerp, Belgium, and then until 1917 was an engineer with N. C. Heisler and Company in what was then St. Petersburg, Russia. From 1917 to 1924 he was technical director for the Telephone and Telegraph Works at Leningrad, Russia, being instructor in telephony at the Electro-technical Institute at Leningrad from 1920 to 1924. Since 1925 A. T. has again been engineer with Bell Telephone Manufacturing Company, Boudewyns Straat 4, in Antwerp. He has patented several improvements in telephony and built many telephone control offices. He writes: "I still play the violin. Am very fond of water-color painting, and have written ten comedies and plays for the stage. I don't smoke yet." André was married in 1908 and had two children: Maria, born in 1912, died in 1915; Nicholas, born in 1910, is still living, as far as we know.

One of the very few classmates who acknowledged receipt of the 1907 "Business and Professional Reference List," mailed to all members of the Class in October, was Albert E. Wiggin, who is manager of reduction departments of Anaconda Copper Mining Company in Great Falls, Mont., and a prominent citizen in financial and civic affairs in that city. He comments: "It is rather unusual that of a Class of about 25 mining engineering graduates of 1907, four of them — Trauerman, Jaccard, Willcomb, and myself — should be located in a small area in Montana, and all of us have been here for 25 or more years." He further writes that Carl Trauerman is a member of the Montana Occupational Diseases Committee, appointed by the last legislature, and that Carl visited his Great Falls plant early in December in official capacity. Albert's daughter, Elizabeth, was graduated from Wellesley College in 1935, and his son, Albert, Jr., is a member of the class of 1940 in Great Falls high school.

A letter from Carl Trauerman dated November 22 states: "A few weeks ago I returned from the annual metal mining convention of the American Mining Congress at Los Angeles — over 2,000 there. Met Jack Kinnear, who presided at one of the sessions. He and I were re-elected for our fourth term on the board of governors for western division. Also met Sam Coupal for the first time in over 30 years. Sam is a live wire in Arizona, especially in the organization of the Arizona Small Mine Operators Association, the largest of its kind in the United States."

Very nicely timed after this letter from Carl came a letter from Sam himself, on the letterhead of the association just referred to, dated December 5. The letterhead bears the legend, "an organization interested in the problems of those who operate small mining properties in Arizona," and lists councils at 48 points in the state. Sam's address is care of the *Mining Journal*, Phoenix, Ariz.

Here are excerpts from two fine letters from Clarence Lamont, dated November 23 and December 6: "As a result of your request in the November Review, I have received a nice letter from Roy Lindsay from Buffalo, N. Y." (Thank you, Roy. I am disappointed that no other '07 men followed my suggestion. — *Secretary*) "Last August we rented our house at Coalinga furnished and moved our trailer to the beach at Santa Monica and are living in it. My general health has much improved, and I have gained 15 pounds, but my eyesight is no better, and I can still walk only with difficulty. . . . We have always wanted to live here at the beach, and how enjoyable it is with the ever noisy Pacific at our front door. Having the finest weather of the year. In the summer the trade winds blow in every afternoon and do not go down at sunset, so it is not very warm in the evening; but now after supper it is warmer along the beach than it is in the summer. Just now the surf is heavy on the full of the moon. Yesterday (December 5) and the day before it was 86 degrees and 88 degrees in the shade at 2:00 P.M. . . . While the big fire was near and presented an awesome sight that night before Thanksgiving, it was held at bay before it reached any of the beautiful homes to the north of us, and it did not jump Santa Monica Canyon. . . . They skate on chemical ice out here in their bathing suits in the hot Californian sun. Something new, a rink built at Los Angeles."

In the October 27 number of *Engineering News-Record*, in connection with the account of the fall meeting of the American Society of Civil Engineers at Rochester, N. Y., October 12 to 14, appears the following, referring to one of our classmates: "E. H. Sargent, chief engineer, Hudson River Regulating District, Albany, gave results of operating the Sacandaga Reservoir in regulating the Hudson River. This is a multi-purpose reservoir, built 8 years ago and having a capacity of 760,000 acre-ft., equivalent to 13.7 in. of run-off of the contributory 1,040 sq. mi. watershed on which the annual average rainfall is 27.6 in. It is this large percentage capacity to which Mr. Sargent pointed as one of the principal factors in making possible the satisfactory multi-purpose use. By use of this reservoir it has been possible to raise the minimum flow in the Hudson from 350 sec.-ft. to above 2,300 sec.-ft. No water passed over the spillway in March, 1936, although flood flows to the Hudson were kept down to 39,500 sec.-ft. whereas without the reservoir probably they would have reached 92,000 sec.-ft., the greatest in the river's recorded history.

"Power companies pay for the use of the water but there are no restrictions on the board as to release of water. Only 3 ft. of storage immediately below the spillway crest is reserved for flood control in the spring. Mr. Sargent stated that absolute integrity is required on the part of the regulating authority to withstand any temptation to sacrifice flood storage for power purposes."

And now in closing, we have some letter material from Sam Very which is so unique in its style and content that we want to pass it on, in spite of the fact that news from him has been in the last three issues of The Review. Three letters were received from Sam during November, all written from Asheville, N. C.; seven typewritten pages altogether, too much to quote completely, and, moreover, some of it very personal. But read these selected passages and chuckle, or maybe shed a tear over Sam's beautifully written comment regarding Sullwold: "When you requested me to report upon the character and senility of the numerous classmates I expected to run afoul of during the transcontinental tour which I began last July, I agreed because I had no idea then that they would duck my interviews. The only ones so far, in the 12,000-mile meander from San Diego, up along the west, over along the north, down along the east, borders of this provincial land of ours which regards itself as pretty hot stuff, who agreed in advance to reveal themselves, were Herbert A. Sullwold, IV, Laurence T. Walker, VII, Floyd A. Naramore, IV, and Winsor Soule, IV. Of these, Sully and Soule were A.W.O.L. when I arrived; Walker declined to be quoted; and I just won't quote Narry's awful lines of profanity. . . .

"Narry was the same, only more so, including, you might say, the gray dome. You recall that? Ominous, at 21; ponderous, you might add. Gray as anything. Think of anything, a battleship, a dust brush, a Mexican hurricane; with streaks in it of Blue Jay mixed with Franklin D. Roosevelt's politics. Same old Narry. 'Sorry to bother you,' says I, strolling in around 4:00 P.M. 'Got anything on the boards?' 'Yes, never been so busy; over six millions of dollars worth of new business came in the day before yesterday; whipping it into shape now; must super-

1907 Continued

vise, tomorrow, so I can collect next day.' 'Narry,' says I, confidentially, in the presence of my wife, 'how many jobs does this meager sum spread over?' 'Five,' says the gray dome. 'Five *paying* jobs?' persists myself. 'Well, *four*, if you want to be so accurate,' snorts my rotund interlocutor. 'Four?' inquires the wife. 'Well, three, to be exact,' admits the battleship part of the dome. 'How about *two*?' I asks, interested at last. 'One, if you must have the low-down,' says our truthful Lothario. 'Narry,' says I, inspired, 'how about your dropping those million-dollar jobs and take us out to a swell seafood dinner on you, where nobody would go that you know, and confess there that you ain't got no business at all?' 'You're on,' says Blue Jay. And we screamed 'hea-hy,' 'hea-hy,' '*hea*-hy.' All of us. . . .

"Sully, one of our sweetest, has gone as most of us would under his circumstances, sour on the world; he isn't interested in the world. He wants to sell his world and go out of it. He can't; he's too important to it but doesn't know it. Sully has recently lost his solar system: his wife, who was most of his all, died last fall. They had dreamed together, and from the dream had sprung loveliness. They planted it and decorated and coddled it; and they lived there, lovers; and she's gone, now, and the beautiful place is for sale for a song, for a love song. I missed Sully by a day, when I called there in the most charming section of the most perfect dwelling region in California, Huntington Palisades, opposite the Santa Monica gorge from Pacific Palisades which is his post office address. Luck the buyer. . . .

"You ask my occupation and business connection: Have neither if an office address is necessary; both, if being willing and able are guides. I am still an architect but don't believe in working for nothing. I like fat fees or nothing, so am still hunting for the ideal client willing to pay in advance for no work. The firm name has been Samuel R. T. Very since 1910. Since 1932 I have been a writer, using a pen name jointly with my wife, Gest Very. We write for awfully high pay — but never get. . . .

"Date of the last wife's first marriage to my first wife's last husband was 14 June, 1930. Name at 4:00 was Annette Eleanor Gest; at 4:15, Mrs. Samuel Rogers Taylor Very. No children, ever." — BRYANT NICHOLS, *Secretary*, 126 Charles Street, Auburndale, Mass. HAROLD S. WONSON, *Assistant Secretary*, Commonwealth Shoe and Leather Company, Whitman, Mass.

1908

Grenville Temple Bridgman, consulting engineer of New York, formerly Vice-President of the Yukon-Pacific Mining Company, the operating company controlled by the Pacific Tin Corporation, has been elected president of that corporation. — Our classmates will be sorry to learn of the death of Mrs. Franklin T. Towle, which occurred on December 6. The sympathy of the Class is extended to Frank and his family in their bereavement.

Charles Collins Kinsman, who was assistant to the president of the Universal Draft Gear Attachment Company in Chicago, Ill., died on November 16. He had been with the company for 27 years. Notices of three other deaths have been received by your Secretary: that of Robert D. Hennen of Morgantown, W. Va., on January 14, 1937, which we have only recently learned of; that of George M. J. Mackay of Stamford, Conn., on July 29; and that of Alden H. Trull of Milton Mass., on October 18. The Class extends its sympathy to their families.

The following changes of address are reported: John T. Ellsworth, 806 Maple Street, Collinsville, Ill.; Joseph F. Florentine, Jr., care of Harris, Burrows and Hicks, 1425 Field Building, Chicago, Ill.; Hobert W. French, 536 Semiole Drive, Erie, Pa.; James T. Gallagher, 2254 Cathedral Avenue, Northwest, Washington, D.C.; John Gianella, care of Charles M. Higgins and Company, Inc., 271 Ninth Street, Brooklyn, N.Y.; Harold P. Gurney, 75 Longwood Avenue, Brookline, Mass.; Joseph W. L. Hale, 24 Marlborough Street, Newburyport, Mass.; James E. Hale, R.D. 7, Eaton Avenue, Akron, Ohio; Paul H. Heimer, 76 Dunklee Street, Concord, N.H.; William C. Kerr, Catonsville, Md.; Emerson F. Lyford, Center Street, Dover, Mass.; Charles W. Morrison, 51 Fifth Avenue, New York City; Joseph B. Sando, Apartment C-2, 2805 Madison Road, Cincinnati, Ohio; George Schobinger, Ulen and Company, 120 Broadway, New York City; Arthur E. Skillings, 83 Easton Street, Allston, Mass.; Clifford L. Wade, 4928 California Street, Omaha, Neb.; Leland E. Wemple, 332 South Michigan Avenue, Chicago, Ill.; Richard W. Wilson, 1617 West 14th Avenue, Vancouver, B.C. — H. LESTON CARTER, *Secretary*, 60 Batterymarch Street, Boston, Mass.

1909

Thirtieth Reunion, Oyster Harbors Club, June 3 to 5. — Paul Wiswall says: "Twenty of the 1909 men here in New York gathered at the Tech Club on December 3 to greet Warren K. Lewis '05. It has been a long time since we have had such a good turnout of our classmates. There may have been a bit of telepathy in the air, for I had heard Doc twice here in New York recently where not a soul had ever had him in any classes, and I found that everyone listened intently to what he said. Maybe his reputation had preceded him.

"In any case, we all listened to Doc's philosophical views on the state of things, the viewpoint of one who is not only a top-flight chemical engineer but whose avocation, I am certain, is the study of the classics of philosophy. What we heard was a treat to us all. We can all read the papers and hear about the state of things in the governments of the world with more perception after hearing Doc Lewis." — CHARLES R. MAIN, *Secretary*, 201 Devonshire Street, Boston, Mass. *Assistant Secretaries:* PAUL M. WISWALL, MAURICE R. SCHARFF, New York; GEORGE E. WALLIS, Chicago.

1910

Undoubtedly most of the classmates read of the tragedy which overtook Phil Hart. Phil was a passenger on the ill-fated air liner which ran out of fuel over the Pacific Ocean and was forced down on the water and subsequently wrecked on the rocky shore. Phil was president of the Pacific Bridge Company at Portland, Ore.

Carl H. Lovejoy is now area engineer for the flood-control work which is being done under the supervision of the United States Army Engineers. He is located at Holyoke, Mass., and his jurisdiction includes local protection work at Holyoke and Northampton. The work at Holyoke will be principally a concrete wall along the Connecticut River, and at Northampton, a new channel for the Mill River. — Lewis W. Riggs visited your Secretary recently. He has developed a new process for cracking oil. — John Gray is one of the fortunate architects who have obtained commissions to design one of the new housing developments to be located in Charlestown, Mass. — HERBERT S. CLEVERDON, *Secretary*, 46 Cornhill, Boston, Mass.

1911

When these notes appear it will be 1939, during which we all hope things will improve steadily. May it be a particularly prosperous one for all '11 men!

Add 1911 juniors at M.I.T.: Frank P. Seeley, V, '42, son of Nat Seeley, II. Like Dad he is a member of Chi Phi fraternity and lives at 22 The Fenway. His next younger brother is at Kent School in England this year. This information was gleaned from Nat's customary family group Christmas card, showing this year the Seeley's and their other two young sons around the fireplace with stockings hung for all.

"Steam Generation in a New England Paper Mill" is the title of an article by Calvin Eldred, VI, in the November issue of *Paper Industry and Paper World*. He is mechanical superintendent for Hollingsworth and Vose Company, manufacturers of rope and jute Manila paper, with plants at East Walpole and West Groton, Mass. It is the boiler plant of the East Walpole mill, the main plant of the company, that is the subject of this article, and the author's note reads: "This article describes the equipment of an early pulverized fuel plant in a New England paper mill. It gives the operating costs of the plant during the ten-year period (1928–1937), a decade of widely varying conditions of business, fuel costs, and steam load — factors which vitally affect the savings of new equipment, no matter how carefully expected results are calculated — and presents figures showing the savings with the new equipment over the old. It is hoped that these figures, and the experience of operation, may be useful in planning new boiler plants."

This modernization program was started 11 years ago and 1911 also enters into the picture when you see Babcock and Wilcox (page Pete White, II) superheaters

1911 Continued

and Riley (page Fred Daniels, VI) Atritas and burners used. In his article Cal says that because of relatively high freight charges for fuel, it was decided to burn bituminous coal in pulverized form. In such cases, he adds, the importance of good coal-handling equipment, particularly between the bunker and the pulverizers, should be stressed. The entire installation has proved to be reliable, and for ten years the steam load has been carried on two boilers with no stand-by boilers except for heating, and during one year the two boilers were both in service for 304 weekdays, being out of service only on Sundays and holidays.

In conclusion Cal pays tribute to the loyalty and conscientious efforts of his boiler operators and compares the expected savings with the actual calculated savings. "In 1927," he says, "it was estimated that the new steam cost would be 56¢ per 1,000 pounds. After correcting for changes in coal prices the actual average price was 56.6¢ for the first year, while the corrected ten-year average was 50.9¢ per 1,000 pounds. Also in 1927 it was estimated that the new equipment would give a certain yearly net saving. Again correcting for the change in coal price, the calculated saving was 2 per cent higher than the estimated for the first year, while over the ten-year period it averaged 8 per cent higher than the estimated — and this over a period that included years of low production."

Jim Greenan, III, who has been consulting engineer during the past five years for Marsman and Company in the Philippines and who returned a few months ago to Carmel, Calif., where his family is residing, has headquarters now in Mill Canyon, Lander County, Nev., where he is operating a gold property.

Good old Charlie Locke '96 sent me a copy of a recent issue of the *Mining Press*, which contained a fine tribute to Jim and his plant, saying the "newly organized Greenan Company assumes a high place among Nevada precious metal operators." October production from this cyanide mill, located near the Eureka-Lander county line in Nevada, was approximately $27,000 gold from 915 tons of ore, surpassing all earlier records of production from the property. During the latter part of the month an average of 40 tons per day was treated and President Greenan said that underground work had continued to yield favorable results and that efforts are being made to develop a tonnage of mill ore that will warrant construction of a cyanide plant of 75 to 100 tons per day. A boarding house is operating at the mine, and a school district with 12 pupils has been established.

On the editorial page appears the following editorial under the heading, "What Energy Can Accomplish": "For a number of years James O. Greenan was widely known in Nevada as a capable engineer and manager of mines; then he went to the Philippines, had charge of the great Benguet Consolidated properties and became chief consulting engineer for the Marsman interests, operating on a major scale at numbers of points in the Islands, in Borneo and elsewhere in the Orient. Returning to the States early this year, Greenan spent some time later in South America and last June again took up his residence in Nevada. Within a brief six-months period he has organized a holding company for his many interests, is operating a gold mine and mill in Lander county that produced $27,000 last month, is head of a dredging enterprise in California that has three floating dredges, has acquired a large cinnabar property in Humboldt county in association with Tasker L. Oddie and is opening a gold property in southern Washoe county with N. H. Getchell as an associate. With interests further expanding, Greenan finds occasion to spend a good part of his time at his Reno office. In general opinion he rates today Nevada's most active mine operator." — A fine tribute, Jim, and we're all proud of you and wish you the best of luck!

Charlie Linehan, I, Rindge Tech teacher and athletic adviser, was reëlected secretary of the Massachusetts State Coaches' Association in Boston in mid-December. Here in Worcester, John D. Hassett, V, an inspector in the State Department of Labor, was elected president of the Emmet Associates, a military group. Through common Worcester friends I have heard from two classmates: Joe Harrington, VI, who was able to drop in at his old family home in Canton for Thanksgiving Day, and B. Darrow, VI, who was in Boston on a flying business trip in mid-December. Joe is still with Standard Alcohol Company of New York City, with headquarters in the Windy City, he and Rose living at 83 Elmwood Avenue, Highland Park, Ill. B. Darrow is still in Akron, Ohio — Yellow Creek Road, R.D. No. 7, to be exact — and his oldest son, Jack, is now taking a postgraduate course at Babson's in Wellesley Hills.

Ted Van Tassel told me last month that Lloyd Cooley, X, was again located in the East, having "caught on" with the Old Gold people in Jersey City. So I wrote to Lloyd and have just been rewarded with a fine reply which was written from St. Louis, where he was on a job in late 1938: "Tell Ted I said he was 'nuts.' Of course *I* may be — possibly I did not explain to him that I was *temporarily* putting into operation a Guardite tobacco-treating unit at Lorillard's Old Gold plant. The process was described in the October *Chemical and Metallurgical Engineering*, which covered the apparatus installed by us at Liggett and Myers here in St. Louis, where they make Granger Rough Cut and Chewing (I hain't larned yet).

"I sure had a swell time while East, but carelessly forgot to 'write to Dennie' for some missing addresses, which meant I missed a lot of classmates I had hoped to see. For instance, I looked up Ridsdale Ellis '09 and offered to help put his sailboat in shape and, as Rufus Zimmerman, IX, shot at me later: 'You looked up all the sailors.' I could have sworn Zim was in Pittsburgh, because a year ago about this time when I was at the Chemical Industries Exposition I saw Zim and his family weeping and wailing and 'ganashing' teeth over prospects of moving to the Smoky City. So — now he says I passed him up, but he forgave me over an 'old-fashioned' in his grand Short Hills home. Saw Don Stevens, II, several times and relived our Maine cruises. Don and Lois and Lois' sister and I went to see Pete White, II, and his bride. Pete and Don are storytellers — *and how* — with gestures. I wore a yellow necktie to Pete's in memory of Class Day. You may recall he teased me about my knitted yellow one and then gave me a green one. Mighty glad to hear that you and your family are all fine, and Treva joins me in the season's heartiest greetings. We are still living at 7438 Kingston Avenue, Chicago, Ill., and I am there some of the time, when not on the road, which is most of the time."

Fred Daniels, VI, told me he was in New York recently and ran into Pete White and our old buddie, Joe Gershberg, VI, who finished with 1912 and is with Consolidated Edison Company in Brooklyn. Word also reached me from the Alumni Office that H. Rossiter Snyder, IV, has left Guilford, Conn., and is to be addressed at Hollywood, Hastings, Barbados, B.W.I. Two other new addresses are David E. Bartlett, VI, 17 Newton Street, Belmont, Mass., and Joseph N. French, IV, 14280 Robson Avenue, Detroit, Mich. — ORVILLE B. DENISON, *Secretary*, Chamber of Commerce, Worcester, Mass. JOHN A. HERLIHY, *Assistant Secretary*, 588 Riverside Avenue, Medford, Mass.

1913

A somewhat abbreviated list of those present at the reunion dinner in June, together with a brief description of their occupations, is interesting: Bob Nichols, I, fuels and equipment, Binghamton, N.Y.; Gerry Lane, V, assistant general superintendent, Kodak Park works of Eastman Kodak Company, Rochester, N.Y.; Gene Macdonald, I, designing and selling large bridges, New York City; Larry Hart, I, with Johns-Manville, New York City; Ken Hamilton, II, production engineer, Mallory Hat Company, Danbury, Conn.; Ken Blake, XIV, division sales manager, Cheney Brothers, New York City; Bill Mattson, I, Vice-President, American Locker Company, Boston; Hap Peck, II, patent attorney, Providence, R.I.; Bill Ready, VI, President, National Company, Inc., manufacturers of radio parts, Malden, Mass.; Bill Brewster, II, Plymouth Cordage Company, Boston; Arthur L. Townsend, II, Associate Professor of Mechanical Engineering at the Institute; Joe MacKinnon, VI, Registrar and Assistant Secretary of the Faculty at Tech; Charles Hiram Wood, I, sells railroad equipment, Boston; Paul Cogan, II, Bethlehem Steel Company, Philadelphia, Pa.; Ad Cardinal, XI, traffic manager, Hoffmann La Roche Company, Nutley, N.J.; Dick Cross, VI, sells oxygen-acetylene equipment, Cambridge, Mass.; Nathan H. Poor, 2d, X, leather manufacturer, Peabody, Mass.; Charles W. Gotherman, VI, engineer for New Jersey Zinc Company, Palmerton, Pa.

1913 Continued

Gill Pardy, VI, manager of service department, Westinghouse Electric and Manufacturing Company, New York City; Andrew Vogel, IV, engineer on manufacturing general staff, General Electric Company, Schenectady, N.Y.; Edward G. Taylor, XIV, instructor of physics, City College, New York City; Luther J. Renfrew, XIV, superintendent of coke plant, Weirton Steel Company, Steubenville, Ohio; Allison Butts, III, professor of electrometallurgy, Lehigh University, Bethlehem, Pa.; Frank T. Smith, XIV, painting and contracting, West Roxbury, Mass.; Steve Braude, X, President of his own metal company, Charlestown, Mass.; Kinsley Dey, XV, consulting engineer, Boston; Millard W. Merrill, XIV, purchasing agent, United States Metals Refining Company, Carteret, N.J.; Frank Morton, X, chief chemist, Lincoln Bleachery and Dye Works, Lonsdale, R.I.; Thomas Collins, X, superintendent of plant, Pittsburgh Plate Glass Company, Newark, N.J.; Silas H. Champlin, V, head of food research, Heekin Can Company, Norwood, Ohio; Sherman R. Ramsdell, V, chairman of science department, High School, Milton, Mass.; Ferdinand H. Pendleton, V, department head, Joseph Middleby, Jr., Inc., Boston; Arthur E. Hirst, V, general superintendent, Pacific Mills, Lawrence, Mass.; Louis S. Walsh, X, examiner, Reconstruction Finance Corporation, Boston; Louisa M. Norton, M.D.,V, pathologist, Concord, Mass.; Alfred L. Loebenberg, X, Vice-President, Barrett Company, New York City; Robert D. Bonney, X, assistant manager of manufacturing, Congoleum-Nairn Company, Kearny, N.J.; Bion L. Pierce, X, Treasurer, Pierce Hardware Company, Taunton, Mass.

George H. Taber, Jr., X, manager of petroleum refining department, Sinclair Refining Company, New York City; John P. Coe, X, sales manager, Naugatuck chemical division, United States Rubber Company, New York City; Gardner R. Alden, X, research department manager, Dennison Manufacturing Company, Framingham, Mass.; Arthur W. Carpenter, X, laboratory manager, Goodrich Rubber Company, Akron, Ohio; Philip S. Barnes, X, sales manager, Pfaudler Company, Rochester, N.Y.; W. Earle Caldwell, X, Treasurer, Florence Casket Company, Florence, Mass.; Allen F. Brewer, III, technical staff, The Texas Company, New York City; George A. Richter, X, director of research, Brown Company, Berlin, N.H.; Miles E. Langley, I, manufacturer of canned foods, Portland, Maine; Charles E. Trull, VI, engineer, Blackstone Valley Gas and Electric Company, Pawtucket, R.I.; Ralph L. Thomas, VI, executive engineer, Consolidated Gas, Electric Light and Power, Baltimore, Md.; Francis H. Achard, VI, instructor, Consolidated Edison Company of New York, New York City; Ernest Weller, VI, engineer, American Telephone and Telegraph, New York City; Samuel E. Rogers, II, fire insurance, National Fire Insurance Company, Wilmington, Del.; J. Warren Lovell, VI, engineering, Collyer Insulated Wire Company, Pawtucket, R.I.; Joe Strachan, I, assistant to vice-president, Congoleum-Nairn Company, Kearny, N.J.; Burton L. Cushing, II, teacher, East Boston High School, Boston; Albert P. Nelson, II, chief engineer, Cities Service Refining Company, East Braintree, Mass.; Archibald H. Spaulding, X, Treasurer, Spaulding-Moss Company, Boston; Robert J. Tullar, II, R.C.A. Manufacturing Company, Camden, N.J.

Allison P. Smith, fruit grower, Stow, Mass.; Arthur L. Brown, II, chief engineer, Associated Factory Mutual Fire Insurance Company, Boston; Clarence W. Brett, I, sales engineer, Johnson and Brett, Inc., New York City; Warren E. Glancy, X, manager of laboratories, Hood Rubber Company, Inc., Watertown, Mass.; Charles G. Fallon, III, steel manufacturer's sales representative, Boston; Warren A. Gentner, I, Board of Water Commissioners, Hartford, Conn.; Alfred L. Higgins, VI, Boston Consolidated Gas Company, Boston; Fred C. Hersom, VI, confectioner, caterer, Chelsea, Mass.; George A. Dempsey, shoe manufacturer, Dover, N.H.; Nathaniel McL. Sage, Placement Officer, M.I.T.; James M. Beale, XI, salesman, Stone, Webster and Blodgett, Boston; Raymond B. Haynes, I, with Wellington and Company, stockbrokers, New York City; John B. Farwell, II, President, Sperry Products, Inc., Brooklyn, N.Y.; Edwin C. Gere, I, major, Quartermaster Corps, United States Army, Winnetka, Ill.; Walter P. Muther, I, sells Lincolns, Lincoln-Zephyrs, and Fords, Boston; Halsey B. Horner, IV, architect, Stone and Webster, Boston; David V. Nason, XIV, J. Laskin and Sons Corporation, Milwaukee, Wis.; William Guild, XI, sales manager, Carley Realty, West Newton, Mass.; Leon W. Parsons, V, Westfield, N.J.; Phil B. Terry, X, Spaulding-Moss Company, Boston; William Newsome Eichorn, XI, Swampscott, Mass.; Harold M. Rand, I, "Doggone Retail Grocer," Boston; Edward Hurst, II, Vice-President and General Manager, United Cotton Products Company, Fall River, Mass.; William N. Flanders, I, National Carbon Company; Louis E. Wright, XIV, bottler, Carbonated Beverages, Cleveland, Ohio; Lester C. Gustin, I, general building construction, Boston; James G. Russell, II, Daniel Russell Boiler Works, Inc., Boston; Gordon G. Howie, I, general manager, Cambridge Gas Light Company, Cambridge, Mass.; Daniel M. Moore, I, civil engineer, Taunton, Mass.; Hilding N. Carlson, XI, teacher, Boston University, Boston; Albert M. Jones, I, lieutenant colonel, United States Army, Boston; Frederick W. Blackwood, VI, appraiser, Associated Factory Mutual Fire Insurance Company, Boston; Walter E. Merrill, XI senior sanitary engineer, Massachusetts Department of Public Health, Boston; Benjamin White, I, general contracting business, Boston; Joe Cohen, X, Vice-President, General Manager, and founder, Atlantic Gelatin Company, Boston.

Marriages are so rare that the following clipping from the New York *Times* is news indeed: "Mr. and Mrs. Christopher L. Ward of this city [Wilmington, Del.] have announced the engagement of their daughter, Miss Alison Ward, to Dr. C. Lalor Burdick [III]. Miss Ward attended the Misses Hebbs's School and was graduated from the Westover School, Middlebury, Conn. She is a member of the Junior League of Wilmington. Her family has long been prominent in Delaware. Her father, a well-known lawyer and author, served recently as chairman of the Delaware Swedish Tercentenary Commission.

"Dr. Burdick is a member of the staff of the development department of E. I. du Pont de Nemours & Co. and is secretary of the Lalor Foundation. Before residing here he was metallurgical and consulting engineer with the firm of Guggenheim Brothers of New York City on various mining and industrial enterprises in Chile. He was graduated from the Massachusetts Institute of Technology and did postgraduate work in Germany and England. The prospective bridegroom is the son of Mrs. Anna Lalor Burdick of Washington, D.C. His previous wife, the former Miss Kathleen Condon of Sands Point, L.I., died in 1935." Subsequent word has come through Professor Locke '96 that this wedding took place in Greenville, Del., on December 16. — FREDERICK D. MURDOCK, *Secretary*, Murdock Webbing Company, Box 784, Pawtucket, R.I.

1914

The New Ocean House, Swampscott, Mass., June 3 and 4. That is the decision of your officers for our 25th reunion. Buck, Charlie, and your Secretary met in New York on December 7, and after weighing all of the many factors involved regarding this particular reunion, took the responsibility for making the above decision. Ross Dickson was also present and was prevailed upon to accept the chairmanship of the reunion committee. Walter Keith, who was in New York from Akron, also attended the meeting and added helpful advice. The 25-year classes now take a prominent part in the Institute's Alumni Day program, and because of this it seemed expedient to have reunion headquarters near Cambridge. As Alumni Day comes on June 5, our reunion date automatically became set as the preceding Saturday and Sunday. Including Alumni Day our reunion will last from Saturday, June 3, through Monday, June 5.

The New Ocean House is a modern hotel located on the North Shore about a dozen miles from Boston. Golf headquarters will be at the Tedesco Country Club, about five minutes' drive from the hotel. There is a 1,000-yard course (free) right at the hotel for the short-game and putting experts. Charlie Fox and other polar bears will try the ocean bathing, but we may have an early spring this year anyway. Officially the reunion will be stag, and the principal events will be on that basis. Alumni Day, however, has many events for the ladies; with this in mind the ladies will also be welcome at the New Ocean House, and arrangements

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will be made for their entertainment. The cost will be no more than at Oyster Harbors five years ago. General rates including greens fees will be about $9.00 per day, and about $2.00 a day less for the non-golfers. Special family rates will be as low as $6.00 per day. Watch the *Fourteen Pointer* for full details.

Walt Keith was in New York because he was attending a dental meeting. Walt is the president of the Hygienic Dental Rubber Company of Akron, which has a unique type of elastic material for dental work, as well as a line of hygienic dental rubber. His display at the Hotel Pennsylvania was most impressive. — While en route to the New York meeting your Secretary met Gardner Derry, also on his way to New York. It was learned from Derry that his principal noncommercial activity for the past two years has been that of a member of the Sharon, Mass., school committee. Derry's position of vice-president in charge of sales of the B. F. Sturtevant Company keeps him traveling around the country quite a bit. — O. C. Hall makes the headlines again! Another daughter, Margaret Louise, was born November 18. Is this the only entry for the reunion class baby?

Johnie Leathers was a prize winner in the Boston *Herald's* "Auto Parade of the Years" contest in November. Johnie did not take top money but came in for one of the lesser awards. Those of us who know Johnie's car wonder a bit about the top winners. — Boston classmates were deeply shocked and grieved on reading in the local papers on December 1 that Dick Favorite had died the preceding evening from an illness of several weeks. Dick took part in the Alumni Fund drive last spring, and his passing came as a great surprise to all of us. For 14 years he was with Stone and Webster and had traveled considerably around the country. To his wife and two daughters, aged 15 and 10, there is extended the sympathy of all of his classmates. — H. B. RICHMOND, *Secretary*, General Radio Company, 30 State Street, Cambridge, Mass. CHARLES P. FISKE, *Assistant Secretary*, 1775 Broadway, New York, N.Y.

1916

Charlie McCarthy, executive head of the engineering work at the Chance-Vought division of United Aircraft, sailed with his wife on the S.S. *Paris* on Friday, December 16, for an extended business trip in France. I hope that later Charlie will be able to give us more news about Christmas in Paris, 1938.

Joel Connolly of Chicago, who recently turned down an offer to come to the New York World's Fair for an important assignment, is now assistant to the president of the Board of Health, Room 710, City Hall, Chicago. He lives at 5316 Carmen Avenue in that city. Joe now has a family consisting of his wife and two children, Ruth Virginia, aged nine, and Joel Irving, Jr., aged seven. His work in Chicago started in 1925 when, under Civil Service, he became chief of the Bureau of Public Health Engineering. In 1937 he was promoted to acting assistant to the president of that body, and in August of this year was certified by the Civil Service Commission to this position, which is the highest in the Board of Health organization, except that of president of the board. While all of the activities of the board are under direction of the president, actually they are supervised by the assistant to the president. Joe is a member of the City Club and the Chicago Congregational Club. He is a director of the Chicago Congregational Union and of the Good Shepherd Community Center; also, chairman of the Conference of Municipal Public Health Engineers and executive councilor of the public health engineering section of the American Public Health Association. I understand also that Joe is a special lecturer in Technology's Department of Biology and Public Health, and a lecturer at the school of engineering of the University of Minnesota. The Class has done pretty well in the field of sanitary engineering and public health. Walt Binger has filled very important positions in New York City, and now Joe is heading the works in Chicago.

Bob Wilson tells me of his recent meeting in Houston, Texas, with Bill Farthing, Kem Dean, and Ralph Bennett. Ralph, who now seems to be traveling under the cognomen of Benny, must be playing a fine game of golf, because Bob Wilson speaks of having two very exciting games with Ralph in Houston.

From Helsingfors, Finland, we have word again from our classmate Laurin Zilliacus, who recently completed a journey around the world. Ten years ago in Helsingfors he started a private school, of which he is headmaster. He is taking active interest in an international educational association that has branches in most countries except those under dictatorship. He is married, has two children — a boy, aged 15, and a girl, aged 13. Zilliacus sends his regards to Earle Pitman, who, I believe, is with the Du Pont Company at Parlin, N.J., and to Bill Leach, who is with the Mathieson Alkali Works at Niagara Falls, N.Y. He wonders if Bill Leach remembers how Dr. Lewis used to say, "Mr. Leach says so and so. That listens good. Now let's see what it means."

In closing these notes, it is very gratifying to call attention to the fact that in the recent alumni gymnasium fund campaign, the Class had a higher per capita gift and a higher average subscription than any other Class later than 1907 and at the same time was well above average in the percentage of the Class subscribing. — JAMES A. BURBANK, *Secretary*, The Travelers Insurance Company, Hartford, Conn. STEVEN R. BERKE, *Associate Secretary*, Coleman Brothers Corporation, 245 State Street, Boston, Mass.

1917

At an annual meeting of the Board of Secretaries, Class of 1917, an inventory was taken and the stock of notes found to be dangerously low. They were limited to the announcement that Irving McDaniel's daughter, Josephine, was married on December 27 to Frank Baker Melson at Atlanta, Ga., and the news that Lin Noyes has recently been elected a director of the American Newspaper Publishers Association. He reports that he is in New York frequently for meetings of that board and that his spring plans include a month's holiday in Florida late in March.

As the situation was rapidly becoming desperate, a representative of the board communicated with Al Lunn, who promptly promised to make up the deficiency. However: "After numerous telephone calls, I found my quest for news fruitless with the exception of the inclosed, which I told you about over the telephone. I'm sorry I couldn't do any better but with a little more notice perhaps I can help next time." The inclosure was a clipping from the *Record* of Sigma Alpha Epsilon for December, as follows: "Walter Cromwell Wood . . . sailing master of the Nautical Association, undergraduate yachting organization of the Massachusetts Institute of Technology, Boston, Mass., is a leader in the development of small boat sailing at the Institute and has become prominent among yachtsmen. In September, with the opening of school, Mr. Wood assumed his new duties as master of the senior house, the residence for fourth year students at the Institute. He is now head of the Narragansett Yacht Fitting Company of Providence, R.I., and is widely known as a designer of special equipment for yachts as well as for his ability as a racing skipper. He has been active in the popularization of small boat racing. The rapidly growing interest in the sport among college groups and the activity of more than 700 Tech students in sailing are due in no small degree to Mr. Wood's knowledge of sailing and his ability as an instructor. During the World War, he was an instructor in the Army Aviation School at Boston Tech and later became Chief of Instruction at the Army Air School at Arcadia, Fla.

"The Nautical Association of the Institute has a student membership of more than 400 and seventy instructing staff. It has thirty-seven Tech-Herreshoff dinghies and one frostbite dinghy. Races are held each Saturday and Sunday during the year except in December, January and February, at which time ice covers the basin of Charles River. Additional races are held during the summer on Tuesdays and Thursdays. Sailing hours are from 7 o'clock in the morning until dusk, seven days per week. Meets are held with other colleges particularly with Harvard, Brown and Dartmouth. A well-organized intercollegiate yacht racing association also includes Yale, Cornell, Williams and Princeton.

"Boats used at the Institute are 12.5 feet long, five feet wide, and have sixty-nine square feet of sail when cat rigged and ninety square feet when sloop rigged. They weigh 175 pounds and may be lifted easily by two men. They are of lap-streak construction, with cedar planking and mahogany trim. The boats are housed on racks in the Pavilion and can be launched in five minutes. Three ratings are given to those sailing at the Pavilion: crew,

1917 Continued

helmsman and racing skipper. A course of instruction is followed in obtaining these ratings, the teaching being done mainly by the students themselves." — RAYMOND STEVENS, *Secretary*, 30 Charles River Road, Cambridge, Mass. PHILIP E. HULBURD, *Assistant Secretary*, Phillips Exeter Academy, Exeter, N.H.

1921

David O. Woodbury has been commissioned by Dodd, Mead and Company to do a popular book on the giant 200-inch telescope now in its final stages of construction at Pasadena, Calif. "The Glass Giant of Palomar" will dramatize the achievement by treating the material as an adventure story of the Jules Verne type without any necessity, however, for resorting to fiction. The new telescope was conceived ten years ago by the late George E. Hale '90 of the Mount Wilson Observatory and will cost $6,000,000 with its laboratory facilities. A visible universe 30 times the size of the present field will be revealed when the project is completed in 1940. Besides providing a running-fire account of the design and unique construction work, "The Glass Giant of Palomar" promises to comprise interviews with famous astronomers and a layman's account of some of the astronomical puzzles which the telescope is expected to unravel, notably proof of the Einstein theory, facts about novae, and settlement of the controversy about Mars. Dave has been engaged in popular-science writing for many years. His published works include the book, "Communication," and many magazine articles and stories. He is also represented by several pages in the "Encyclopaedia Britannica" and is noted for occasional masterpieces of humor and pathos especially prepared for and featured by this column of Technologia Twentyonnica.

Peirce-Phelps, Inc., constitutes a very successful all-Technology team located in the Keystone State, with principal offices at 5th and Noble Streets, Philadelphia, and 619 Walnut Street, Harrisburg. J. Trevor Peirce and his old side-kick, Charlie Phelps '24, are exclusive distributors for the entire Crosley line of radios, refrigerators, washers, ranges — all except the Cincinnati Reds — Chrysler Airtemp, and other electrical appliances. Trev is reported in *Radio Weekly* as covering a lot of territory getting his full weight behind a promotional campaign that just mows 'em down!

From the Boston *Evening Transcript* of November 14: "Albert L. Edson, Superintendent of the East Boston Airport, today succeeded Major Clarence E. Hodge as commanding officer of the 26th Division Aviation, Massachusetts National Guard. His rank is raised from captain to major. "Major Edson, a graduate of M.I.T., was stationed at several Army Air Corps depots and completed his bombing course with the highest score in his class. He has been airport superintendent since his appointment by former Mayor Nichols in 1929." Congratulations, Al!

Word has been received of the death on January 11, 1937, of John Lambert Weston of Hancock, N.H., who was associated with us in Course VI. On behalf of the Class, sincerest sympathy is extended to his family.

The meandering of various members of the tribe has brought the following changes of address: Arthur N. Brambach, VI, 3125 East Laurelhurst Drive, Seattle, Wash.; Maxwell K. Burckett, VI, 17 Oberlin Street, Maplewood, N.J.; Albert B. Clarkson, XV, 71 Linmore Street, Hartford, Conn.; Zambry P. Giddens, Jr., 47 East 88th Street, New York City; Manuel M. Green, V, 116 Coolidge Road, Worcester, Mass.; Dr. Oscar F. Neitzke, X, 10 Center Street, Waterville, Maine; Herbert W. Reinhard, XV, 1460 Pitner Avenue, Evanston, Ill.; Isadore H. Rogovin, XIII, 39 Ellison Road, Newton Center, Mass.; George T. Welch, XV, 55 Marian Avenue, Poughkeepsie, N.Y.

Where's that note you promised yourself to send us right after New Year's? — RAYMOND A. ST. LAURENT, *Secretary*, Rogers Paper Manufacturing Company, Manchester, Conn. CAROLE A. CLARKE, *Assistant Secretary*, 10 University Avenue, Chatham, N.J.

1923

The following from *Science*, issue of June 24, has just caught up with me: "It was reported to the meetings of the American Physical Society by Dorothy W. Weeks, of Wilson College, and Professor George R. Harrison, of the Massachusetts Institute of Technology, that a new and superior tool for identifying chemical elements by the characteristic lines which they emit when excited by an electric arc, or other means, is an improved spectrum of the positions of the very complex lines in the spectrum of iron. The spacing of these lines through the colors of the visible, and invisible, spectrum differs from one element to another and gives a rapid means of identification, even in very minute samples. The number of identified lines in the iron spectrum — which already number in the thousands — has now been trebled. The basic method of locating the position of a line in the spectrum of an unknown element, is to photograph the unknown spectrum and then, immediately adjacent to it, the spectrum of iron. The complex iron spectrum, with each of its line positions known, serves as a reference standard to help locate the lines of the unknown spectrum. By trebling the lines positively identified in the iron spectrum, scientists now have smaller gaps in their reference positions and the errors of measuring between reference points are lessened."

Left from reunion correspondence are a couple of bits of information not previously recorded. J. H. Cox writes from Pittsburgh: "I have been guiding the development and engineering of mercury-arc rectifiers for Westinghouse Electric for some years." — Ed Miller writes from Rochester: "Have gotten a line of furniture designed . . . to start merchandising plans . . . need to capitalize . . . operating an upholstery shop as an experimental base. My six kids (three boys, three girls), all full of the old man's pep, and he has his tongue hanging out most of the time!"

James O'Reilly Coleman married Helen Cecelia Carlsen in New York, September 24. The announcement says they will be at home after November 15 at Scarsdale Manor, Scarsdale, N.Y. — The following is from a clipping in the New York *Sun* of October 22: "Mrs. Evelyn Mary Waters, the daughter of Mrs. Cornelius Joseph Waters of Ridgewood, L.I., and Westport, N.Y., is being married today to John Carlton Sargent, the son of Mr. and Mrs. Thomas Little Sargent of Lowell, Mass. Rev. Charles Kanzler is performing the ceremony in the Chapel of Our Lady at St. Patrick's Cathedral. A reception follows in the Jansen Suite of the Waldorf-Astoria. . . . Mr. Sargent is associated with the New York Telephone Company. Upon their return from a three-week wedding trip to the West Indies, the young couple will make their home in Jackson Heights."

Among candidates listed for office in the American Chemical Society for 1939, *Industrial and Engineering Chemistry's* News Edition for October 20 notes the name of Per K. Frolich, director of the chemical laboratories of Standard Oil Development Company. — The following is from the Newton news in the Boston *Globe* of November 23: "Miles N. Clair, 17 Hope St., West Newton, was one of three graduates of Drexel Institute of Technology, Philadelphia, to be elected to membership in the Drexel Chapter of the national honorary scholastic society of Phi Kappa Phi. Mr. Clair, vice-president of the Thompson & Lichtner Company, Boston, consulting engineers, was graduated from Drexel Institute in 1921 and received his M.S. in civil engineering from M.I.T. in 1923."

Fred H. Travers, formerly with General Electric at Bridgeport, Conn., has been appointed electrical engineer in the State Department of Public Works, Hartford. (The foregoing item is from the November issue of the *VI-A News*.) — Ed Averell, civil engineer of Lynnfield, Mass., mentions in a recent letter that he lately ran into J. C. Flaherty, who is resident engineer on a P.W.A. job in Natick.

Checking up on addresses a few weeks ago, I unearthed business connections of the following, not recently noted here: Edwin Hobbs is with Clinton E. Hobbs Company (chains, hoists, cranes), 203 Chelsea Street, Everett, Mass. — Earl D. Brown is now production superintendent at Kellogg's in Battle Creek, Mich. Roderick B. Jones is a member of the firm of Brown and Jones, patent attorneys, 60 East 42d Street, New York, N.Y.

S. R. Kiehel writes: "I have left the job of superintendent and technical director of the Billings-Chapin Company to start my own company, the Citrox Laboratories, to manufacture specialties for the medical profession. So far we are struggling beginners. This shift had nothing to do with my moving to the country, however. We moved out here on a 25-acre farm last August so that the kids could have more room to stretch their legs. Chesterland is suburban to Cleveland — a delightful rolling country adjacent to Gates Mills."

Your Secretary has been promoted to

1923 Continued

chief engineer of the National Fire Protection Association. I had a very pleasant business trip in November to Havana to attend the First Pan American Congress of Municipalities held there, having been invited to present a paper on municipal fire fighting and fire prevention. I took advantage of the trip to stop in Miami where my visit was fortunately timed so that I was able to attend a meeting of the Technology Club of South Florida, which I represent on the Alumni Council. — HORATIO L. BOND, *Secretary*, 457 Washington Street, Braintree, Mass. James A. Pennypacker, *Assistant Secretary*, 96 Monroe Road, Quincy, Mass.

1924

First big news of the coming 15th reunion, to be held the week-end before Alumni Day in June, is an announcement from Bill Robinson that chairmanship of the reunion committee has been accepted by Bill Correale. That's real news to the fortunate ones who attended the 10th anniversary in 1934 at Marblehead, for with New York's commissioner of water, gas, and electricity as its leader, the gathering is an assured success already. By the time this reaches print (it is written before Christmas), other members of the Class will have heard from Bill, asking them to become members of the committee. Letters to the Secretary already attest the wide interest.

Lest it be forgotten, the movie story is repeated here. A feature of the reunion (and it is only one of many) will be the moving picture of classmates in all parts of the world, now being put together from 16-millimeter films sent to the Secretary. If you are proud of yourself and your family, be sure to take, or have taken, a few feet of film for this purpose. If you get to the reunion, it will make it that much more interesting; and if you don't, then let the film represent you. In any event, let's have the film. There may even be a prize for the best one.

An important appointment which should long ago have been noted here is that of Avery Ashdown of the Institute's Department of Chemistry as master of the Graduate House, now in its new quarters in the building which our generation knew as Riverbank Court, across Massachusetts Avenue from the main buildings.

Through the haze of the club car of the *Merchant's Limited* in early December, the Secretary spotted the familiar face of Phil Bates. After several years at the Institute, Phil is now inventor or producer or purveyor of vitamins for the United Drug Company in Boston. Probably none of these terms is just right, but Phil promised to drop us a note setting forth the correct situation and, since he didn't, memory will have to serve. Once again, and not for the last time, keep the reunion in mind, and send in those pictures, now. — FRANCIS A. BARRETT, *General Secretary*, 50 Oliver Street, Boston, Mass.

1925

For last month I had a fine letter from Chink Drew, who is with A. Schrader's Sons in California, but unfortunately I mislaid it and have not been able to find it. However, I'd like to ask Chink to write again and I'll treat his contribution with more care. I received the following excerpt from a letter to Jim Killian, the retiring Editor of The Review: "Nelson H. Defoe is the exhibit consultant with the firm of Modern Art Crafts, Inc., Associates, exhibit builders in New York. His work at the present time is concerned with selling exhibit construction services to World's Fair exhibitors, and his firm is constructing the exhibits for Ford, Pennsylvania Railroad, Ecuador, and one of the Focal Theme exhibits."

I quote from the November *VI-A News:* "It is with pride we note that A. L. Samuel '25, a member of the technical staff of the Bell Telephone Laboratories in New York, recently received the prize of the Institute of Radio Engineers for the best paper published in the I.R.E. Proceedings during 1937." We should be glad to find from Samuel, or some other member of the I.R.E., the nature of the paper which resulted in this award. Our congratulations! — HOLLIS F. WARE, *General Secretary*, 17 Green Road, Medford, Mass. F. LEROY FOSTER, *Assistant Secretary*, Room 6-202, M.I.T. Cambridge, Mass.

1926

The first unit in the new recreational facilities at the Institute — to which this Class contributed very generously — is now getting under way. It is a field house to go on the land west of Massachusetts Avenue, and its architects are Herbert Beckwith and Lawrence B. Anderson '30, both of the staff of the Institute's School of Architecture.

John Wills, who is one of the Institute's Honorary Secretaries in the New Jersey area, has moved to Princeton where he is taking advanced work in economics. — M. B. Morgan, assistant chief engineer of the Meadville plant of the American Viscose Corporation, has been appointed chief engineer in the place of Hobart O. Davidson '20 who has been named chief engineer for the entire corporation. A local Pennsylvania paper reported: "Changes in personnel at the American Viscose Corporation, carrying with them deserved recognition of the ability and fine services of two of the company's engineers, are of genuine interest to the Meadville community. . . . A younger man, trained, too, at the Massachusetts Institute of Technology and fitted by 10 years of experience as assistant chief engineer of the Meadville plant, will take his place. His genial personality, his training and his apparent ability make M. B. Morgan particularly suited to the position to which he has advanced. . . ."

Too late for inclusion in the class notes of last month was the announcement on November 27 of the engagement of Miss Evelyn Giardino of Dorchester, Mass., to Angelo Costello of Rockland, Mass. For the past eight years Costello has been on engineering work in Venezuela. — Mike Radoslovich, Bill Latham reports in a recent letter, did the architectural design on the Long Island railroad station at the New York World's Fair and on the flying bridge in back of the administration building. This bridge has prompted wide comment as an able piece of architectural design. — J. RHYNE KILLIAN, JR., *General Secretary*, Room 3-208, M.I.T., Cambridge, Mass.

1928

It is with extreme regret and sorrow that we announce the unfortunate accidental death on Thursday, December 22, of our good friend and fellow classmate, Cy Meagher. His passing still doesn't seem real. The following account of the accident is taken from the Boston *Globe* of December 23: "A 31 year old Peabody man was fatally injured and five other persons badly shaken up in a collision involving three automobiles at Chelsea and Brooks Streets, East Boston, last night. Cyril B. Meager 31, of 13 State St., Peabody, driver and sole occupant of one of the cars, was fatally injured. Found slumped on the floor under the dashboard Meagher was taken from the wreck by two unidentified pedestrians and rushed to Strong Hospital where he died at 8:06. Identification was established by his driver's license. . . ."

We mourn the passing of a grand fellow and extend our sincere sympathy to his family and many friends. As you all well remember, Cy was vice-president of our Class and captain of the track team during our senior year and was always very active in class affairs. Only this past spring, he did a magnificent job for the Class and the Institute as chairman of our class committee to raise money for providing improved recreational facilities for Tech students.

James A. McCarthy, I, is the proud father of a first child — born on July 29 — a son, Anthony James McCarthy. Congratulations! We wish to send sincere congratulations also to Joe Parks on his advancement to the position of vice-president of the Chambon Company of Garfield, N.J., manufacturers of printing and duplicating machinery. Joe, we're proud to know you!

We present here the second and final installment of Pete Moyano's letter, started in the January issue: "After working on several other things, like the preliminary survey of a branch line of the railroad from a station called Ruiz to another point on the coast of the state of Nayarit called Túxpam, with its line of levels and the preliminary location of the line and things like putting up water tanks, and so on, there finally sprang up our last revolution at the end of 1929.

"Things got too hot around where I was, so I quit and took up another job with the Mexican Light and Power Company. This is, or was, an English-Canadian company controlled by the Canadian Finance Corporation with headquarters at Toronto, Canada, and which I believe is now controlled by a more or less international concern named Sofina with headquarters at some city in Belgium. They sent me up to where they were building their last hydroelectric project, which was in the state of Michoacán in a place called Tepuxtepec.

1928 Continued

"There I was put in charge of the construction of the powerhouse. Also had to lend a hand in the construction of the power tunnel and pipe tunnel, and when the time came, had to give transit points, levels, and inspect the installation of the penstock line. This was what I called an international mess because, just imagine, the penstock line was put up by the Ferrum people, a Polish concern; the turbines, which were of the horizontal Francis type, were put up by the Voigt people, Germans; the generators, by Siemens, Germans; the powerhouse crane was Swiss; and the outside substation was from Westinghouse. Isn't this an international mess? And on top of all this there were a Russian engineer, Ashurkoff; an English one, Davidson; an American from Texas, Stevenson; several Italians; a German, Zaunboss; and yours truly, a Mexican — all gotten together under an American fellow by the name of Willis Ranney. By the way, he was an M.I.T. graduate ['07], and I say 'was' because I learned that he committed suicide in San Antonio by jumping from the 18th story of a building there.

"We had to get through the work, and we did. In other words I was there till the first of September of 1930. I unfortunately remember this date very well because I went home right away to spend a month's vacation, and on the eighth of September my mother died. This upset all of my plans. I had planned to leave for the city of São Paulo, Brazil, South America, where the same Canadian Finance Corporation has an electrical subsidiary, but the whole thing had to be given up because I could not leave dad alone.

"So I got in again with the Mexican Light and Power. They kept me in their home office in Mexico City in their civil engineering department until something went wrong in Tepuxtepec. What happened was this: The location of the surge tank right in between the power and the pipe tunnels happened to strike right on a fault called the San Antonio fault. There was then quite a settling of the surge tank, and they had to install a steel differential surge tank of the Johnson type; this was sent up from the States, and I was shipped back to Tepuxtepec to inspect the installation of it, so that I spent another year or so in Tepuxtepec. By this time I was getting fed up with the Mexican Light, and I finally quit in October or November of 1931 to get into the construction business on my own. Ever since, I have been building all kinds of dwelling houses — quite a number of them — four or five factories, and anything else that comes up. Since last January I have been doing government construction work.

" . . . I am married now and have been for the last six years and have a couple of kids — a boy and a girl. . . ." — GEORGE I. CHATFIELD, *General Secretary*, 6 Alben Street, Winchester, Mass.

1930

Your Secretary has decided that whenever he becomes a bit pressed for news he will go where a line is forming and stand there. Sooner or later a 1930 man will come along. Within the last two weeks I have stood in two lines and met two members of our Class. On December 12 my wife and I attended the reception given in honor of Dean Emerson and the Faculty members of the School of Architecture in the new Rogers Building at the Institute. Standing in front of us were Ronald Jameson, IV, and Mrs. Jameson. They have been married three and one-half years, and Ron is affiliated with an architectural firm in Boston. The next evening I stood in line at the Boston Garden to get some tickets for Sonja Henie's ice carnival. Along came Freddie Ladd, II, who is doing research and experimental work for a machine manufacturer in Boston. Fred will marry Miss Margery B. Kilbourn of Groton, Mass., in June.

This seems to be an open season on our classmates who captained Institute teams. Ladd was leader of the track team, and now comes word from Chicago that Bob Nelson, XVI, was married last month to Miss Ruth Tilden of Winnetka, Ill. You will remember that Bob was captain of basketball. — Jarvis Wilson, VI-A, is the proud dad of a baby boy named David Laurie, who arrived October 12. To all three members of the Class may we offer congratulations.

From Oklahoma, Bill Dickerman, X, writes that he has resigned his position with the Pure Oil Company to accept one in New York with the Alco Products division of American Locomotive, where his work will continue to be along the line of petroleum refining. Bill received his master's degree in fuel and gas engineering in 1931 at the Institute. — May we remind you again that June, 1940, will mark our tenth anniversary as Alumni and that you are requested, one and all, to plan to attend our tenth reunion. The Class of 1928 had 81 members at Saybrook, Conn., last June, and so we have a good mark to shoot at. Any suggestions as to the location for our tenth will be heartily accepted, although the crowd of us who were at Toy Town Tavern in Winchendon in 1935 may be hard to convince as to the merits of another spot. Let's start the stew boiling now and talk about the next reunion to all classmates we meet. See you in 1940! — PARKER H. STARRATT, *General Secretary*, 75 Fenno Street, Wollaston, Mass.

1933

As this is being written, we are all in the midst of the pre-Christmas rush and everyone's thoughts are elsewhere than on The Review. However, we do have two newspaper clippings: One announces the engagement of Miss Mary Alling White to Stephen Joseph Alling. Alling is practicing architecture. The other announces the marriage of Miss Jean E. Hogenauer to Robert Adolf Hentschel on November 19 at Fairfield, Conn. The Hentschels plan to live in Bridgeport. Besides his bachelor's degree from the Institute, Bob has his doctor of science degree from Tech also. — On November 24, Miss Mary Margaret Taylor was married to Guido Garbarino in Pelham Bay Park, N.Y. — That's the limit of our information this month, and we hope we have more for you next time. — GEORGE HENNING, JR., *General Secretary*, Belmont Smelting and Refining Works, Inc., 330 Belmont Avenue, Brooklyn, N.Y. ROBERT M. KIMBALL, *Assistant Secretary*, Room 3-102, M.I.T., Cambridge, Mass.

1934

The supply of news for this month is mainly in two letters from Johnny Newbegin and Brad Ellenwood. Newbegin writes that he has been out collecting more subject matter for fireside chats with his grandchildren. Last September he and Johnny Westfall borrowed Tuffy Emery's 26-foot sloop and started on a trip which was intended for health and recreation. However, misfortune dogged them from the start and turned their pleasure trip into a near catastrophe. On September 21, which was the day of the big wind here in New England, they got caught off Provincetown and apparently had a pretty harrowing time before they got the boat into port. I am sorry Johnny did not supply more details, for I am sure they would be very interesting. Perhaps we will be able to give you the story in novel form in a later issue. The damage to the boat was of such an extent that it took five weeks of hard work to put it back into shape again. To cap the climax of the adventure, John's Ford, which he had left in New Bedford, was washed away by the tidal wave which accompanied the hurricane.

Brad Ellenwood has several interesting bits of news to report, of which the most important by far, to Brad in particular, is his marriage to Miss Alice Telfer of Boston which took place last October 8. They had what might be called a flying honeymoon, both figuratively and literally, to Montreal and Quebec and various surrounding points of interest. The trip by plane was one of the bumpiest of the season, and Brad wonders if he and his wife will ever completely recover from it. Brad's job as clerk of works at the new Wellesley High School was completed the last part of October, and since then he has been in the office of Jackson and Moreland in Boston as a structural engineer.

Joe Fishman, XVII, is still with the Priggen Steel Building Company and is still going strong as a designer. Bob M. Becker is at present in Troy, N.Y., working for the Cline Construction Company on a large remodeling job. Frank Cosgrove "whose silence is as profound as the water supply project — the Quabbin Dam" on which he is still working, is living in Ware, Mass. Sam Joroff has put aside his steel helmet and is back again with his dad in New York.

John W. Alder, who is in the employ of Porter Brothers Corporation, operating dredges in Montana, reports that his company has moved him to Helena, Mont. His work will be largely surveying and mapping. The company has constructed a new dredge at Granite, Mont., and Alder finished up the surveying work

1934 Continued

there. However, he is continuing this line of work in connection with the gold-dredging property of his company in Helena, where they have been operating a gold dredge for three years. He had made contact with Carl Stratton, who is employed at the East Helena smelter of the American Smelting and Refining Company, and he had also met Mrs. Stratton.

An engagement which will be of interest to all of us is that of Herbert W. Andrews to Miss Blanche Hungerford Johnston, daughter of Mr. and Mrs. Ernest H. Johnston of Westfield, N.J. Herb is still working for the DeFlorez Engineering Company of New York City. — I heard from Bob Roulston not long ago, as he was preparing to make a flying trip to Montreal to do some work on a large air-conditioning system which his company is installing. As we have mentioned before, Bob is working for the B. F. Sturtevant Company, in Hyde Park, Mass., in the air-conditioning division. — Reports from Schenectady say that Jim Burnham is still working for General Electric, still building model racing boats, and still devising trick ski bindings. Ski *heil*, Jim!

We would like to make this a bigger, better, and busier column, but we can't compose a column without news from you fellows. Last month there wasn't enough information available to make a column worth while. How about appropriating some of your valuable time for the benefit of your classmates and scribble off a line or two? — JOHN G. CALLAN, JR., *General Secretary*, 184 Ames Street, Sharon, Mass. ROBERT C. BECKER, *Assistant Secretary*, South American Development Company, Apartado 655, Guayaquil, Ecuador, S.A.

1935

I hope you fellows enjoyed the class survey. An apology is due to some of you. In the December issue of The Review I stated that those of you who had not received a copy of the survey could do so by writing to me. Some of you wrote in to say that you had sent in the questionnaire card and that you should have received a survey. Quite right, but the difficulty was this: These notes for The Review have to be written almost six weeks before you receive the issue. Consequently I had to look ahead and estimate when the class survey would be published. The estimate was a little optimistic, for actually the survey was not mailed until after the December issue of The Review had reached you. If you still think you have been overlooked, drop me a line and say so.

In the last issue I asked how you liked not having any news to read. I could almost ask the same question this time. Strange as it may seem to you, there can be no news in this column unless each of you is conscientious enough to write in occasionally. However, there is some news to report. One additional marriage has come to attention since the survey was written. Jim Monagle and Elizabeth Haworth were married November 27. Another item of interest is that Ed Clark has been elected secretary of the Montana Society of the M.I.T. Congratulations, Ed.

The report on Carlos Lavenas in the survey was not correct. Last May, Carl resigned his job with Du Pont with the intention of returning to the States. However, conditions seemed so unsettled that he decided to take a job with the Armco International Corporation in Buenos Aires. He is a sales engineer in the drainage department, peddling culverts, bridges, sewers, and so on. He finds the work interesting and has plenty to do. Carl expects to return to the States for the World's Fair in New York.

Leonard Wiener wrote in just a few days too late to get the information included in the survey. Len is now with the propeller division of Curtiss Wright Corporation, doing design and analytical work. He reports that while there are a good many Tech men in the organization, he is the only '35 man. — Otto Zwanzig was one of those who wrote to complain about not receiving a copy of the survey. In his letter he mentioned that John Mooring, Ed Helwith, and he had attended Parker's marriage, with the hope of dissuading him from taking the disastrous step but to no avail.

Ben Beede sent a rather lengthy epistle giving an account of his activities in the last three years. In July, 1935, he started with the Franklin Rayon Corporation of Providence as mechanical engineer (position now held by Jeff Farmer). While in Providence, Ben maintained bachelor quarters with Gene Newell, who at that time was with Universal Machine. The last of January, 1937, Ben left the Franklin Rayon job to join the Foxboro Company. He spent the following two months at Foxboro, Mass., and then went to Cleveland. At that time he was working with the paper mills in the Middle West — Ohio, Michigan, and Pennsylvania in particular — and as far south as Savannah, Ga., and Canton, N.C. In October he was transferred to the Chicago office and spent most of his time in the pulp and paper mills of Wisconsin, Upper Michigan, Minnesota, and Illinois. In September of this year he was again transferred, this time to the sunny southland, with headquarters at Atlanta, Ga. His territory now embraces all the southern states from North Carolina to Florida and as far west as Texas. That's quite a bit of country to cover, Ben. Ben and Foxboro are getting right in on the ground floor of the new developments in the paper industry in the southern states. Thanks for the big boost to the column.

That winds up the news for this month. Don't put off that letter another day — write *now*. — ROBERT J. GRANBERG, *General Secretary*, Central Y.M.C.A., 100 Gibbs Street, Rochester, N.Y. RICHARD LAWRENCE, *Assistant Secretary*, 111 Waban Hill Road North, Chestnut Hill, Mass.

1938

These notes are rather brief this month, but it is the hope of your Secretaries that this is nothing more than a lull before the storm of news. We start now with the announcement of the engagement of Bruce Scott Old to Miss Katharine Gardner Day, daughter of Mr. and Mrs. Frank A. Day of Newton, Mass. Bruce received his doctor's degree last June. — Chester C. Lawrence was wed late in November to Miss Virginia Pope of Wollaston, Mass. They plan to make their home in Ashmont. — Hal Cooper was married to Miss Edith Nicholson, and Emanuel M. Blue to Miss Harriet Tieburg early in September.

We were very glad to hear recently from Haskell Gordon, XVI, who writes: "I spent four months working with the Curtiss Propeller Division in New Jersey, designing three-blade, electric, controllable-pitch propellers. In November I switched affiliations to the naval aircraft factory in Philadelphia, where I'm designing a hydraulic control system for navy airplanes. The work is quite interesting, and I'm getting a shot at experimental vibration also. Also working here is Joe Pasternack, M.S. in XVI. Joe and I have a swell little apartment in West Philadelphia (Suite 311, 4101 Spruce Street; they probably have an extra bed for transients) and Joe is utilizing Professor Newell's ('19) advanced structural notes in his stress analysis of *monocoque* fuselages." (Wow!) Haskell would like to read a little about Course XVI in these pages, so address a letter to Jay Au Werter, at the Hotel Sheraton in Boston, who has expressed willingness to pass on any news he might receive.

Here's a cheery note coming at the holiday season: Your Secretary writes: "Walter Baldyga, X, is distilling good cheer at Seagram's, someplace in Kentucky. . . . Horace Homer, also X, might be said to be distilling too. His distilled products are not so palatable, however, as he is working with Cities Service. . . . He is located in Boston." Dale also adds the news that John Cody is assisting in the chemical engineering department of Northwestern University, and that Martin Cines has the honor of working under Professor Freundlich, the eminent physical chemist at Wisconsin.

We who are struggling unsuccessfully to reconcile altogether too large a budget with altogether too small an income are delighted to hear that at least one of us is making budgets balance: Bill Roper, XV, has quite a little to say about his job. To quote: "I'm working for the Electrolux Corporation in Old Greenwich, Conn., manufacturers of the world's finest vacuum cleaners. I started in the engineering department as 'cost engineer' with the object of my work the study of costs from the point of view of cost reduction." Bill is back now at the old budget work, setting up a manufacturing budget.

We repeat the very good news that Vernon Lippitt, VI, who is now at the Institute working for his master's degree, has been awarded a Rhodes Scholarship for two years' study at Oxford. — DALE F. MORGAN, *General Secretary*, Graduate House, M.I.T., Cambridge, Mass. LLOYD BERGESON, *Assistant Secretary*, 885 Beacon Street, Newton Centre, Mass.

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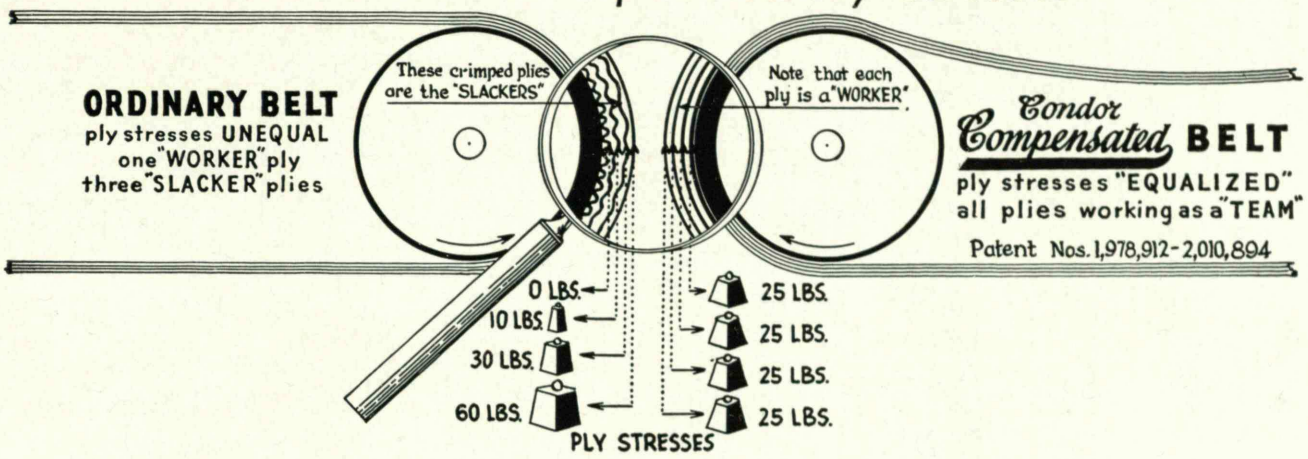

COMPARE the principle of construction of Condor Compensated Belt with that of ordinary rubber belt in the diagram above. Note that when Condor Compensated is flexed around the pulley—where the destructive work is done—all plies work together as a team, each bearing an equal share of the load. Whereas, in ordinary rubber belt, the outside ply carries the greater load—the "back-breaking" load, as indicated by the weights, that ruptures or separates the outer plies and breaks the fasteners—and the inside plies buckle and crimp to shirk their load, to increase creep and wear—resulting in premature breakdown.

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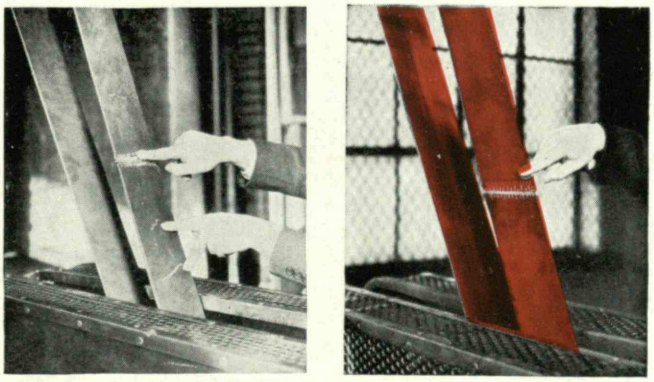

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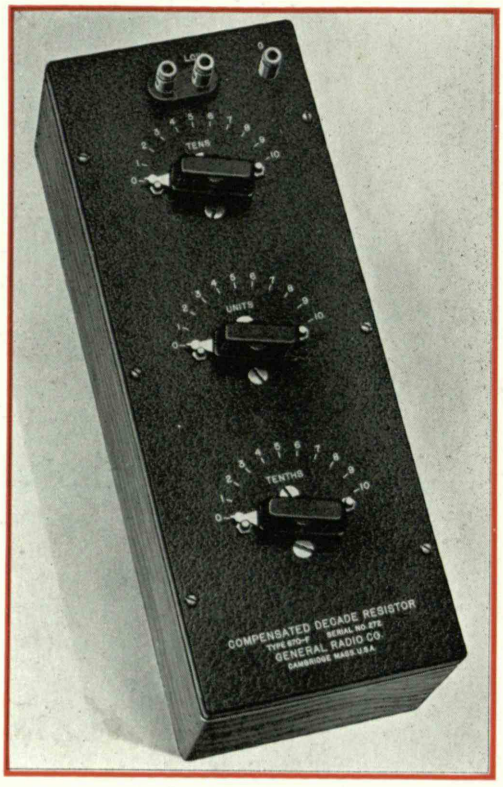

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